This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

SCIENTIA
OF THE
MICHIGAN

SCIENTIA
OF THE
OF MICHIGAN

E. Mackenzie sc.

Watt, Esq. F.R.S.

hed by A. Tilloch Jan^{y} 1. 1806

London, Edinburgh, and Dublin THE

PHILOSOPHICAL MAGAZINE:

COMPREHENDING

THE VARIOUS BRANCHES OF SCIENCE,

THE LIBERAL AND FINE ARTS,

AGRICULTURE, MANUFACTURES,

AND

COMMERCE.

BY ALEXANDER TILLOCH,

HONORARY MEMBER OF THE ROYAL IRISH ACADEMY, &c. &c. &c.

" Nec aranearum sane textus ideo melior quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes." Just. Lips. *Monit. Polit.* lib. i. cap 1.

VOL. XXIII.

For OCTOBER, NOVEMBER, and DECEMBER, 1805;
and JANUARY 1806.

LONDON:
Printed by R. Taylor and Co., 38, Shoe Lane, Fleet Street:
And sold by Messrs. Richardson; Cadell and Davies; Longman,
Hurst, Rees, and Orme; Symonds; Murray; Highley;
Vernor and Hood; Harding; London: Bell and
Bradfute, Edinburgh; Brash and Reid, and
D. Nevin, Glasgow; and Gilbert
and Hodges, Dublin.

1806.

Johnson
5·15-42
45528

CONTENTS OF VOL. XXIII.

I. *SOME original Remarks on a Variety of the Genus Acarus, belonging to the Order Aptera, found on the Wings, &c. of a feathered Fly of the Order Diptera. By Mr.* JOHN SNART, *Optician* .. .. .. *Page* 3

II. *On a Colour for marking the Ends of Cotton or Linen Cloths capable of resisting the Operations of bleaching, and likewise the most complicated Manufacture of printed Cloths, without extending beyond the Limits of the original Impression. By M.* HAUFFMAN 8

III. *A Varnish which preserves Vessels made of Copper or other Metals from the Action of Acids of a certain Strength. By M.* HAUFFMAN 13

IV. *New Method of extracting raw Sugar from the Beet-root. By M.* ACHARD 14

V. *An experimental Essay on Salt as a Manure, and as a Condiment mixed with the Food of Animals. By the Rev.* EDMUND CARTWRIGHT, *of Woburn* 16

VI. *On the Analysis of Soils, as connected with their Improvement. By* HUMPHRY DAVY, *Esq. F.R.S. Professor of Chemistry to the Board of Agriculture and to the Royal Institution* 26

VII. *Extract from a Memoir on the Steeping of Wool, and on the Influence of its different States on Dyeing. By M.* J. L. ROARD, *Director of the Dyeing Establishment in the Imperial Manufactories. Read in the French National Institute* 42

VIII. *New Galvanic Discoveries, by M.* RITTER. *Extracted from a Letter from M.* CHRIST. BERNOULLI 51

IX. *Galvanic Experiments. By M.* RITTER 54

X. *Chemical Experiments on Mercury. By Messrs.* BRAAMCAMP *and* SIQUEIRA-OLIVA, *of Portugal* 56

XI. *New Method of preparing Alum from Pyrites and Clay. By M.* LAMPADIUS, *Professor of Chemistry and Metallurgy at the School of Freyberg* 65

XII. *Twenty-fourth Communication from Dr.* THORNTON, *relative to Pneumatic Medicine* 68

XIII. *A specific Remedy for the Tinea Capitis. By Mr.* JAMES BARLOW 69

XIV. *On the Decomposition of Alkaline Sulphurets by the Oxides of Lead and of Manganese. By M.* DIZE 70

XV. *Process for preparing pure Gallic Acid. By M.* RICHTER 74

XVI. *Biographical Sketch of Mr.* GEORGE MARGETS, *Chronometer-maker to the East India Company, and Author of the Longitude and Horary Tables* 76

XVII. *Acidulation of Sulphate of Potash. By M.* OERSTED 80

ONTENTS.

,earned Societies 80
Iiscellaneous Articles 87
ats of Angora: in a Letter from
PICTET *of Geneva* 97
achine by which all the Thread-work
e done in a standing Posture. By
N, *of Fettleworth, near Petworth,*
.. .. 102
nmercial Policy. By J.B. GALT,
.. .. 104
n of Tin in part decomposed into
'in. By M. BUCHOLZ 112
otion. By ANTHONY CARLISLE,
the Croonian Lecture. Read be-
November 8, 1804 113
ARTHUR WOOLF's *new Improve-*
es 123
etter from M. RINCK, *of Treysa,*
n Alkaline Prussiates 128
nic Observations. By M. OER-
.. .. 129
of Aquatinta Engraving; with a
ratus to prevent the Inconvenience
ce from the Fumes which are pro-
the Acid employed in the Process
130
discovered to be a noble Metal; on
operties. By J. B. RICHTER 137
w Vegetable Substance discovered
.. .. 142
the Torpid State of the North Ame-
ENJAMIN SMITH BARTON, *M.D.*
143
ining pure Cobalt. By M. TROMS-
.. .. 145
f analysing Stones containing fixed
the Boracid Acid. By HUMPHRY
, *Professor of Chemistry in the*
.. .. 146
n the singular Figure of the Planet
M HERSCHEL, *LL.D. F.R.S.* 147
d Observations upon the Contrac-
at low Temperatures. By THO-
M.D. F.R.S. Edin., Professor of
rsity of Edinburgh 153
Substance which possesses the prin-
operties of Tannin. By CHARLES
.S. 173

CONTENTS.

XXXVII. *Proceedings of Learned Societies* 182

XXXVIII. *Intelligence and Miscellaneous Articles* ... 187

XXXIX. *Examination of different Processes for obtaining the Separation of Nickel from Cobalt. By* Christian Frederic Bucholz 193

XL. *An experimental Inquiry into the Nature of Gravelly and Calculous Concretions in the Human Subject; and the Effects of Alkaline and Acid Substances on them, in and out of the Body. By* Thomas Egan, *M.D. M.R.I.A.* 199

XLI. *Twenty-fifth Communication from Dr.* Thornton, *relative to Pneumatic Medicine* 212

XLII. *On a new Metal recently discovered by M.* Tromsdorff 213

XLIII. *On muscular Motion. By* Anthony Carlisle, *Esq. F.R.S.: being the Croonian Lecture. Read before the Royal Society November* 8, 1804 217

XLIV. *Information on the Mines and Manufactures of the East Indies, and other Subjects. By* J. Machlachlan, *Esq. of Calcutta* 227

XLV. *On the Direction and Velocity of the Motion of the Sun and Solar System. By* William Herschel, *LL.D. F.R.S.* 230

XLVI. *Life of* John Bevis, *M.D. F.R.S. &c. Communicated by Mr.* T. S. Evans, *of the Royal Military Academy, Woolwich* 247

XLVII. *On the magnetic Attraction of Oxides of Iron. By* Timothy Lane, *Esq. F.R.S.* 253

XLVIII. *Extract from a Memoir of Messrs.* Fourcroy *and* Vauquelin *upon the Discovery of a new inflammable and detonating Substance formed by the Action of Nitric Acid on Indigo and Animal Matters. By* A. Laugier 255

XLIX. *Third Communication from Mr.* W. Peel, *of Cambridge. On the Production of Muriates by the Galvanic and Electric Decomposition of Water* .. 257

L. *Experiments on Gum Arabic and Gum Adraganth. By M.* Vauquelin 259

LI. *A Proposal for destroying the Fire- and Choak-Damps of Coal Mines; and their Production explained on the Principles of modern Chemistry: addressed to the Owners and Agents of Coal Works, &c.* 261

LII. *Letter of M.* Gay-Lussac *to M.* Berthollet, *on the Presence of Fluoric Acid in Animal Substances* 264

LIII. *Proceedings of Learned Societies* 268

LIV. *Intelligence and Miscellaneous Articles* 282

LV. *Abstract of Observations on a diurnal Variation of the Barometer between the Tropics. By* J. Horsburgh, *Esq. In a Letter to* Henry Cavendish, *Esq. F.R.S.* 289

nto the Nature of Gravelly
e Human Subject; and the
Substances on them, in and
GAN, M.D. M.R.I.A. 295
OCK, Esq. of Mountains-
Dr. LYSTER, respecting a
on a Heifer 308
D CHARLES's Machine for
nant-Colonel HARDY 309
Dispensaries in general;
the Cases in the Finsbury
last three Months of the
ly JOHN TAUNTON, Esq.
insbury Dispensaries, and
y, &c. 312
ENE's new Apparatus for
tion. By M. DAYEUX 317
nd Remarks on an artificial
rincipal characteristic Pro-
ARLES HATCHETT, Esq.
.. .. 320
by Messrs. FOURCROY and
ena and the Products which
treated with Nitric Acid.
.. .. 326
eans of rendering Smutty
anslated from the Biblio-
y the Rev. JOHN DUBOUR-
.. .. 332
atent granted to ARTHUR
the County of Middlesex,
the Construction of Steam-
.. .. 333
e of Blighted Corn. Ex-
at the Institute 30th Ven-
srs. FOURCROY and VAU-
.. .. 346
into the Proportion of the
uids constituting the Atmo-
.. .. 349
Torpedo, by Messrs. HUM-
Extracted from a Letter
BERTHOLLET, dated Rome,
.. .. 356
w Books 360
Societies 363
aneous Articles .. 371

THE
PHILOSOPHICAL MAGAZINE.

I. *Some original Remarks on a Variety of the Genus Acarus, belonging to the Order Aptera, found on the Wings, &c. of a feathered Fly of the Order Diptera.* By Mr. John Snart, *Optician.*

To the Editor of the Philosophical Magazine.

SIR,

I should not have thought myself very well employed in writing the following particulars of so trivial a creature as I am about to treat of, were it not with the view of drawing some new inferences, and even an unequivocal line of demarcation between animalcula that are of a perfect generation and those which are not so, although they are often indiscriminately blended: and though I will not peremptorily dare to dogmatically assert that the one in question is the *ne plus ultra* of nature's perfect beings, in a small way; yet it is the utmost boundary I have seen, or even read of in those entomological writers who have given simple statements of facts only. I do not mean to include the animalcula infusoria in this idea; for it is plain that nature's manner of perpetuating a species by mere vegetative impregnation is essentially different and distinct from sexual intercourse, or copulation; although it may be urged by some (what I think is very doubtful), that the germ or ova of the former is always shed or ejected in the water, &c. beforehand: but as the common pediculus, or louse, it is evident, is originally formed from the exudation of the skin, which vegetates, becomes vascular, organizes, and lastly animates, and assumes loco-motion (without a father, and is therefore *sui generis*), this also may be the case with the creature of which I am writing, which may originally be produced in this way, as well as many others; but after they have attained the capacity of propagating their species *per se*, provident nature, whose characteristics are simplicity and œconomy, and who never makes use of two sorts of means where one will answer the intended end, may leave them to shift for themselves when capable. As we take away the leading-strings when the child can walk alone;

e to diversify her manner of per-
y leaving them to the impulses she

opagation in this species, to which
s, that emboldens me to think that
erwise insignificant, is entitled to
art of natural history called *ento-*
s source, it, being so small, though
sequence.
vious that this secret diversity of
whose inexhaustible source we are
esh information, is the cause of
s writers upon the several branches
ecause, if one man should see a
etative impregnation only, which
oduced by sexual commerce, and
f the other means, they will reci-
other; while a knowledge of both
without hypothesis or concession;
nsects one male impregnation will
r, several generations. The crea-
he multitude of examples which
parent is no less wonderful, but
er smaller than in her greater pro-
presumption, that were our optics
of viewing her exquisite works
y exist a part of her diversified
s as much more minute than the
r with by means of our natural
or in size to the elephant, the sup-
he mammoth, or the more doubt-

spark is pent in narrow bounds,
tor's philosophic wounds,
npal'd alive to feast his eyes,
nizing throes and sighs,)
eath, as when a giant dies!

efore us we have indubitable proof
stinct and separate volition, with
g all the voluntary as well as in-
e, together with the œconomy of
n, &c. &c.; which, in my ideas,
question, at least in this stage of
merely impregnated existence as
vegetative creation, and therefore
n the sentient list of nature's ani-
mated

mated works. And in this particular I think a natural line of demarcation between the monads of matter, organic particles, or first rudiments of future being, and distinct beings, is quite apparent.

For it is not the oscillatory motion of the semen masculinum, the attractive and repulsive motion of some of the animalcula infusoria, or the rapid vegetative growth of the mutilated parts of these semi-animated creatures called polypi, that so properly constitutes life, consciousness, and perfect being; but predilections, volition, propagation of species, &c. are primary characteristics of being: and from these criteria we ought, *à posteriori*, to draw our inferences of different degrees or modes of existence, because they are so much more satisfactory than the indefinite one of locomotion, or any other of the non-naturals.

From these particulars I infer that this creature is neither larva nor infusoria, but a perfect insect; because the one cannot propagate, and the other is not begotten by an identical parent. And it is plain that it differs very essentially from the animated moleculæ or organic monads, or particles of the semen masculinum, which are rather the primitive rudiments of future beings than beings themselves.

It is as far back as May 1803 since I first made the discovery of these insects; but, as I would not impertinently obtrude every trifling discovery upon the world, lest it should have been published before (and I despise plagiarism), I have let it lie by ever since, that I might inform myself of this circumstance did it exist; and by this forbearance I have discovered that there are as many as five-and-thirty varieties of this genus, known in the Linnæan catalogue, chiefly distinguished by the numbers and length of thorns, or hairs, which issue from their posterior parts. But of this variety no particular mention is made by that great man, that I can learn; and this, together with some original remarks, which my attention to the subject has enabled me to make, seems to justify the present observations.

In the year and month above mentioned I happened to catch a feathered fly of the order *diptera*, which curiosity prompted me to reserve for the microscope, with a view of examining its beautiful plumage, or feathers, with which the legs are plated or covered, and the wings striated and bordered: each wing has six of these striæ of delicate fimbriated feathers, and fimbriated with a border of the same, issuing out at an angle of about thirty degrees from their source: the other part of the wings is reticulated by veins, so as to ap-

pear

e whole fly about the size of the

ition of the plumage, &c. I ca-
ct of this paper: whereupon I
iich enabled me to see that every
and that the one I first saw was
ut that they were the common
ly is infested; which indeed is
considered that far less creatures
ator; for even that notably dis-
e is not exempt, but is over-run
n return for the compliments he

t was now diverted from the fly
mbent tormentors, which I soon
arous kind, and that some hun-
tered over one wing, several of
arents while they perambulated
rwards nidified, or hatched.
efore, that the eggs of this insect
but instead thereof the parent
h them; for by means of some
either exudes from the parent, or
ered, they firmly adhere to her:
uppose this supply is from the
e ova are brought to perfection;
ed they harden and fall off; after
elopment takes place. And here
f essential service, as it not only
maturity, but also stimulates the
t purpose of nature, which they,
orm posteriorwise. But I never
o this act until they were placed
of the eggs hatched anterior to
vere slow and languid heretofore;
e reanimated, with the greatest
nning about with amazing cele-
and semi-transparency of their
arance of moving prolate sphe-
colla, and quite as clear through-
heir blood is as limpid as distilled
impediment to the sight. And
l them to magnified several thou-

---

ex, gorged with a serrated collar, is found
have some kind of vermin.

sand times, they appeared as large as walnuts, and I could distinguish every part with ease. The ova, or eggs, were also seen as large as kidney beans, and looked like polished mother-of-pearl; and, owing to the solar rays, as finely variegated, with all that soft delicacy of prismatic tint so peculiar to that shell.

The legs of these insects, which are eight in number, are so small in proportion to the bulk of their bodies, that if the creatures happen to fall from any eminent part of the fly, upon which they feed, and get upon their backs, they are as unable to recover their feet as a tortoise; partly on account of their want of the vertebral joints or spines, and partly from the inconsiderable weight of their legs to form a counterpoise. But what they are deficient in in these respects is by provident nature compensated for by their ingenuity and address, as is plain by their taking advantage of any adventitious opportunity for their relief that may present itself, and which they have the sagacity to improve and make subservient to their present convenience: for, each leg being composed of four articulations terminating in a double talon, they catch hold of as many of their young as are adequate to form a sufficient weight of lever, when properly applied, to restore them; to which purpose they place them all on one side; and so completely counteract the weight of their bodies, and recover their lost position.

The facility and address with which they wield six or eight small ones (quite as easily as a man can a walking-cane) not only argues great strength of body but great ingenuity also; while the infant tribe appear to sympathize with the incumbent parent while in that supine posture; who no sooner falls than she is surrounded by these little auxiliaries, each of which places itself on some part of the parent, as if emulous to assist (and it cannot be to suck, because they are not of the mammalia class). Thus we may see in an insect, which in its first development is not more than a sixteenth part the size of a small grain of sand, and in its mature state not bigger than the grain itself, all those powers of instinctive motion that can be found in one ever so large or noble.

Of how small worth, then, are the attainments of nine-tenths of the human species, who perform a dull, unmeaning, sensual round of unconscious mechanic actions, as they feel themselves impelled by instinct, not one of which is superior to those of these beings, whom they destroy

creatures had an existence! (I omit
heir faults.)

fe! what all its functions too!
iv'n to mere ephemera!—
pow'r is wondrous cheap!
rent's largess is unknown!—
heminence), vain man, forgo,
rn this gift to more account.
ing man is censur'd thus,
all'd by a very mite,
aits the drowsy sensu'list,
s, sleeps, and toys; then dies a fool!

should be thought of sufficient mo-
a place in your vehicle of philoso-
ying them before the public you will
, sir, your already obliged

Servant at command,
JOHN SNART.

ation of the Plate.

ck view of the acarus, with the ova
ng ones, showing the comparative
grown insect.

ew, showing the manner in which
n the sternum and belly: also the
usual number of hairs which issue
,—in general about thirteen or four-

---

arking the Ends of Cotton or Linen isting the Operations of bleaching, complicated Manufacture of printed ding beyond the Limits of the ori- y M. HAUFFMAN[*].

roper for marking cloths of every
t no substance or drug soluble in
r into its composition. It is equally
stances intended for any compo-
ot turn white when combined with
should remain indissoluble in acids
d for bleaching, as well as for the
n the fabrication of printed cloths.
h drying oils cannot, therefore,
oyed for this kind of marks, be-
iable to be attacked by alkaline and

---

[*] *Annales de Chimie*, No. 158.

saponaceous leys, but because in drying slowly they run, and very often occasion spots.

If those composed with spirit-varnish were even not attended with the inconveniences of speedy evaporation and desiccation, still it would be as improper to employ them as the preceding, because turpentines and resins are very easily transformed into soap. Nor can gum-copal be used for colours for marking, because it is detached from the stuff by mere ebullition in water.

By employing oil of turpentine, which evaporates and dries less speedily than alcohol, I have succeeded in obtaining a black composition, which to me appeared capable of being used with advantage for marking cloths. It is made by dissolving slowly in oil of turpentine, in a sand-bath, continually stirring it, a quarter of its weight of asphaltum, or bitumen of Judea, broken into small pieces, and afterwards mixing with it as much as possible of lamp-black, or black produced by any mineral substance whatever, highly coloured, and in very fine powder; either carburet of iron, sulphuret of lead, or any other. The colour will be obtained more or less thick according to the proportions of the oil of turpentine and bitumen; it will mark exceedingly well without running, observing the just proportions, and diluting it with a new portion of oil of turpentine, if while it is in use it acquires too much consistency. This bituminous colour bears equally well the action of alkaline leys and of oxygen, and resists all acids of a certain strength.

Finding it unnecessary to continue the trials of oily colours, I undertook the aqueous experiments in the following order:

Exp. I. I dissolved in four ounces of water one ounce of sulphate of manganese, deprived of its water of crystallization, such as is obtained by procuring the oxygen gas of the black oxide of manganese, by means of sulphuric acid, and by increasing the violence of the fire towards the conclusion of the operation, so as to ignite the retort. This solution was thickened with a dram of fine gum-dragon in powder, and coloured with lamp-black, to render the accuracy of the impression more visible, which is executed very easily with this black, saline, metallic mass, of which, however, no use can be made, excepting the ends of the marked cloths be plunged into alkaline ley, without previously passing it through water, to take away the saline matters. The ley may be made with potash or soda, in the proportion of one part of alkali to from nine to twelve parts of water: it may be used in the state of carbonate, or rendered

half a part of quicklime. The pre-
of manganese from marks, by one
kaline leys, will take place (allowing
e lamp-black) under the colour of a
will gradually turn brown by the
n of the atmospheric air. The al-
to brown will take place very spee-
stronger intensity, approaching to
y means of an alkaline oxygenated
hs, the ends of which have been
utes into any kind of alkaline ley
s of brown oxide of manganese re-
rocesses of bleaching, and all acids
d by them, but likewise the more
mployed in printing cloths.

cetic acid more affinity for manga-
d were it not disengaged as easily
nese as from the acetic solution of
nd desiccation, inalterable marks
e most simple manner, by causing
e to adhere to stuffs by means of
rds exposing that oxide to the at-
of the oxygen of the atmospheric
olution of manganese may very
mixing, in suitable proportions,
solution of sulphate of manga-
c solution possesses no advantage
nganese for marking stuffs, as it is
be used, to subject it in every re-
described in Exp. I., and as it is
viseable to employ it.

es of sulphate of manganese dis-
f acetic solution of iron, concen-
s, furnish, when thickened with
m-dragon, a deep yellow colour,
o a brown if treated exactly in the
. I. The acetic solution of iron
her advantage than that of causing
o dry rather more speedily; for the
ore or less rapidly in acids, in pro-
xygenation or oxidation. I prefer
ing marking colours to the other
ause those substances weaken the
eir interposition: if, however, in
loths, gum-dragon should be at-
ies, it would then be necessary to

Exp. IV. If, in the disengagement of oxygen gas from a mixture of black oxide of manganese and sulphuric acid, care be taken not to push the fire to incandescence, the saline residue is blackish; but with a violent heat it turns to a yellowish white. On dissolving this residue you separate from it, by washing, an oxide of a dark gray, which acquires the consistence of paste on the filter when deprived of the aqueous vehicle. On mixing this gray paste-like oxide with ever so small a quantity of water, thickened with gum-dragon, and printing with it, you obtain marks of an extremely dark gray, which dry very speedily. This gray colour cannot be removed by water, though it may not have been steeped in an alkaline ley: it is so tenacious and unalterable, that it withstands not only the action of all the acids of a certain strength, but likewise all the processes of bleaching, as well as the most complicated fabrication of printed stuffs, without attracting the colouring parts of any dye whatever.

Exp. V. Were it not for the apprehension of weakening a little the place where the stuffs are marked, equal parts of a mixture of the above-mentioned gray paste and a nitro-muriatic solution of tin, charged with one-fourth part of the metal, and thickened with gum-dragon, might be employed with advantage. This colour is equally unalterable with that of the preceding experiment, and it possesses the additional advantage of attracting, by its oxide of tin saturated with oxygen, the colouring parts of any dye whatever, and turning to dark brown in dyeing with madder. I shall observe on this occasion, that, by this madder-dye, the colours of marks produced by oxide of manganese, saturated with oxygen, turn to a dark brown approaching to black, whereas in a state less oxygenated they assume shades more or less different. However, in all these circumstances it is necessary that there should be as much metallic oxide as possible, without which you obtain only light tints of various other colours.

Exp. VI. Seeing that many insoluble metallic oxides nevertheless acquire the property of adhering to stuffs by means of acids, I resolved to try if the same was the case with the precipitate of manganese saturated with oxygen. For this purpose I dissolved one part of sulphate of manganese in six parts of water; and afterwards proceeding with the precipitation to the point of saturation with a caustic alkaline ley composed of half a part of quicklime, four parts of water, and one part of calcined potash of commerce, I obtained a precipitate of a yellowish white. I then added to the whole aqueous mass a sufficient quantity of oxygenated muriatic

itate was completely saturated with
olour ceased to increase in inten
ı a filter the precipitate, or brown
: it stand till, by the loss of water,
nce of paste. This brown paste
it of acetic acid, as highly concen-
only a weak brownish tint; and it
he addition of any of the three acids,
nitric, weakened with water. I ob-
favourable on mixing a part of the
paste with an equal portion of acetic
g twenty degrees on the areometer
ed with gum-dragon. This acetic
ing only the quantity of oxygen
of the metal, seized, by a much
ess of the oxygen of the brown
ch was afterwards completely dis-
rom the whole resulted a mixture
nt metals of a reddish yellow co-
nsparent: which confirms the ob-
d metal requires less acid for its
in a contrary state; and that,
an excess of acid, this solution,
capable of admitting a portion of
ing disturbed. This mixed solu-
d me only a rust yellow, which
ied away entirely at the expiration
an that required to remove a less
To obtain from these two metallic
ır impossible to be effaced, it was
rks for some minutes in an oxy-
ley, in order to precipitate, and
ne oxide of manganese. By the
part of the brown paste of manga-
olution of the two metals, this new
ed, and disturbed the whole. This
ened, yielded only a faint brownish
naining a considerable time in di-.

atic solution of tin, which pos-
izing the oxygen of various sub-
l, and mineral, and which, for
antageously employed in dyeing,
ure of printed stuffs, the darkest
of iron are deprived of colour, and
demonstrates the more powerful
han of manganese or iron.

Note. No apprehension need be entertained respecting the effect of steeping marked cloths in an alkaline ley; it is an operation which is speedily performed without any perceptible loss of potash or of soda, if you first proceed to wash with ley, for which purpose that which is left may be again employed. If, conformably to the practice I have followed for a number of years, the alkalies for leys were made caustic with quicklime, a great quantity of soda and potash would be saved, and at the same time a superior effect would be produced.

III. *A Varnish which preserves Vessels made of Copper or other Metals from the Action of Acids of a certain Strength. By M.* HAUFFMAN [*].

To obtain from copal a varnish fit for this purpose, of a whiteness and transparency resembling water, it is necessary to employ copal reduced to a very fine powder, and to expose it, with twelve parts of fine oil of turpentine, for some hours, or till it is completely dissolved, to the moderate heat of a sand-bath, in a capsule of glass, stone, or porcelain; observing to stir the whole very often with a glass rod. It is at the moment when it begins to acquire the consistence of syrup that the total dissolution of the copal takes place by means of the stirring, which is facilitated by the occasional addition of a small quantity of oil of turpentine to replace that which evaporates. Three-fourths of the oil of turpentine which are lost by the evaporation in open vessels may be saved by making the solution in a long-necked matrass, exposed to a sand-bath a sufficient time to complete the dissolution of the copal, shaking it at the same time very frequently. The varnish obtained by one or the other of these methods turns of a yellowish colour if the heat be too violent; and as its application would be difficult when its consistence too much resembles that of honey, it is adviseable, instead of diluting it with oil of turpentine, to mix it with one-fourth or one-fifth of its weight of alcohol; taking care not to put more than is necessary, for an excess would turn it to a milky white by the precipitation of part of the copal, which admits into solution with it only a certain quantity of alcohol without being precipitated. Vessels of copper, or of any other metal, may receive one, two, or three coats of this varnish, and ought each time to be thoroughly dried in an oven; after which they

---

[*] From the *Annales de Chimie*, No. 158.

to be washed with boiling water,
ng a heat of a still more elevated
ng the varnish; but at all events
to rub the vessels with sand, or

---

xtracting raw Sugar from the
By M. Achard*.

y cleansed, must be subjected to
ck juice of a dark colour will be
sugar, contains also albumen, ex-
substances, which must be sepa-
obtained. In this separation con-
the process.
pper boiler mix 100 pounds of the
th three ounces six drams of sul-
pound of water, and immediately
ls, in which it must be left stand-
wenty-four hours. Twelve hours
not sustain any injury in twenty-
any alteration of the juice. To
l, incorporate with the juice seven
ashes, and afterwards two ounces
me slaked with water. The sul-
he albumen, and the ashes, with
l, separate the acid in the form of
Indeed, it is a well known fact,
of raw sugar in the West Indies,
uses in Europe, lime is employed
and crystallization of sugar.
s been performed, it is necessary
beet-root; for which purpose it is
et in such a manner that the fire
m. The fire is increased to a de-
llition without stirring the liquid.
ed, and the scum is taken off as
n of large black flakes. The li-
hrough a wooden strainer, taking
e it too much, lest the sediment
nd stop the pores of the strainer.
t upon the filter serve as food for

ed and filtered, is poured into a
, to the height of only six inches,

---

es Journal der Chemie.

and is then evaporated with a brisk fire. By this method the juice is prevented from being converted into a mucoso-saccharine liquid, which resists crystallization.

When, by evaporation, the liquid is reduced to half its quantity, remove it into vessels, six feet high and six inches wide, having a cock at the distance of six inches from the bottom; and there let it remain two or three days. In this interval the juice deposits the rest of its impurities, and especially the gypsum which it retained. At the end of this time draw off the liquid, and pour it again, but only to the height of three inches, into the evaporating copper, and proceed to thicken it by a fire, gradually augmented to ebullition. In proportion as the sugar becomes concentrated, care must be taken to diminish the fire, to prevent it from burning, which would render it quite unfit to be converted into loaf sugar. When the juice has acquired the necessary consistence, the fire must immediately be taken from under the boiler. In half an hour pour the juice, thus boiled to a due consistence, into cones or moulds, the points of which are covered with a piece of linen cloth, and into which has been put a small quantity of sugar-candy broken into coarse pieces; after which remove the moulds into a place whose temperature is between ten and twenty degrees of Reaumur's thermometer. When the different operations have been well executed, the greatest part of the sugar is crystallized in the space of twenty-four hours. If it is boiled too much, the whole is converted into a granulated mass, the interstices of which are filled with melasses.

When all the sugar is well crystallized, uncover the point of the mould, and place it over an earthen vessel, that the melasses may drain off: this, according as the juice is more or less boiled, requires three or four weeks. The sugar remains in the moulds, of a yellow colour, more or less white, and in crystalline grains, of a larger or smaller size, according to the success of the process.

M. Achard, with a view to save time, and to dispense with the necessity of employing vessels for settling, made an alteration in this method, which he at first followed. To the juice, when half evaporated, and gently boiling, he added, for 1,200 pounds of the roots, five quarts of skimmed milk, and a little afterwards one quart of vinegar, and in this manner effected the second clarification immediately in the boiler.

By the process of refining, all the products furnished by West India sugar may be obtained from this sugar of beet-root, and by claying it may be rendered equally white.

say on Salt as a Manure, and as
ith the Food of Animals. By the
RIGHT, of Woburn.*

effects of salt as a manure to be
here can be no doubt but the wis-
ould devise some means by which,
revenue, the farmer might apply
culture.

f salt as a manure is a subject on
n is much divided: its advocates,
king effects of salt water on the
asionally irrigated by the sea at
at the fertilizing virtue of such
saline quality, without taking into
y of animal and vegetable matter
ularly near the coast, and where
lves) must necessarily hold in so-

contrary opinion, considering salt
satisfy themselves that it is impos-
e friendly to vegetation which re-
ocess indispensable in substances
f plants. To get over this diffi-
ctured, nay, there have not been
reat name too) who have even at-
alt in small quantities accelerates,
s known to resist, putrefaction; a
er, I shall not willingly yield my
aded that effects are not, in all
their causes. The operation of
t be, uniform; and when, to ap-
ome other cause obtrudes itself,
rvation, which, operating at the
ry cause, joins in giving a result,
ccount for, we consider as ano-

be at variance with each other is
for, having the wide field of ima-
before them to expatiate in, it is
deed it is unavoidable, that some
ay. But what shall we say to the
stency which prevail on this sub-
ject

---

the Board of Agriculture, which adjudged
this essay.

ject amongst practical farmers? Nothing, indeed, can be more contradictory than the different reports that have been made on the effects of salt, as a manure, by those who have even brought it to the test of actual experiment. As there is no reason to question the veracity of the reporters, we must look for the grounds of their disagreement in some predominating circumstance or other, which at the time escaped their observation. Indeed, the success or failure of an agricultural experiment depends so frequently on causes which can neither be controlled nor foreseen, and so foreign from those which were expected to operate, that it is not to be wondered at if the repetition of the very same experiment gives oftentimes a different result.

As it is not the business of this paper to support a theory, but to detail what has been practised; not to contend for an opinion, but to state facts; the few observations which may be hazarded will be such only as are required merely in explanation of occurrences as they arise. I shall endeavour to give, therefore, as simple a relation as possible of the experiments I have tried, to ascertain the advantages or disadvantages which may attend the use of salt as a manure, and also when mixed with the food of animals.

It may be necessary, first of all, to premise, that the soil on which my experiments were tried is a ferruginous sand, brought to a due texture and consistence by a liberal covering of pond mud. Of this soil, in its improved state I mean, by the accession of pond mud (for, having been used merely as a nursery for raising forest trees previous to these experiments, the nursery-man had not thought it necessary to make use of any other manure), the following is the analysis:

	Grains.
400 grains gave of siliceous sand of different degrees of fineness about - - -	280
Of finely divided matter, which appeared in the form of clay - - - -	104
Loss in water - - - -	16
	400

The 104 grains of finely divided matter contained of carbonate of lime - - -	18
Of oxide of iron - - - -	7
Loss by incineration (most probably from vegetable decomposing matter) - - -	17

The remainder principally silex and alumine.

s of either gypsum or phosphate

bove analysis that these experi-
have been tried on a soil better
sults; for of its component parts
oxide of iron possibly excepted)
gment or restrain the peculiar
mployed.

04, a certain portion of this soil
yard wide and forty long. Of
nured (the first excepted) as fol-

el.
.
wo pecks.
bushels.
pecks.
hels.
three bushels.
ree bushels.
es, nine pounds.
huric acid.
.
.
um, peat.
s.

-dust.
aves.
.
graves.

N. B. The quantities of each ingredient the same as when used singly.

hole was planted with potatoes,
nd, that the general experiment
all possible accuracy, each bed
f sets.

few days after the plants ap-
whole was carefully examined,
nce of each row (as far at least
ppearances) was as carefully registered.

gistered. The best row was decidedly No. 7, malt-dust, after which they followed as under:

No. 11. Chandler's graves.
16. Salt, lime, gypsum, peat.
25. Salt, graves.
20. Salt, malt-dust.
9. Decayed leaves.
4. Soot.
2. Salt.
1. No manure.
5. Wood-ashes.
8. Peat.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
17. Salt, soot.
18. Salt, wood-ashes.
21. Salt, peat.
22. Salt, peat, bone-dust.
23. Salt, decayed leaves.
3. Lime.
6. Saw-dust.
10. Fresh dung.
12. Salt, lime.
15. Salt, lime, dung.
24. Salt, peat-ashes.
19. Salt, saw-dust.

On the 28th of May, fourteen days afterwards, the apparent vigour of the plants was in the following order.

No. 7. Malt-dust.
11. Chandler's graves.
4. Soot.
8. Peat.
16. Salt, lime, gypsum, peat.
17. Salt, soot.
20. Salt, malt-dust.
21. Salt, peat.
23. Salt, decayed leaves.
25. Salt, graves.
1. No manure
2. Salt.
5. Wood-ashes.
9. Decayed leaves.
13. Salt, lime, sulphuric acid.
14. Salt, lime, peat.
18. Salt, wood-ashes.
24. Salt, peat-ashes.

dust.

the potatoes were taken up,
ow was in succession as fol-

luced -	240
- -	220
- -	217
t, lime -	201
- -	199
- - -	198
- - -	195
- - -	192
- -	192
- -	189
- - -	187
es - -	187
- -	185
- -	184
- -	183
- -	180
ust - -	178
- -	175
ric acid -	175
- -	171
- -	167
- - -	159
- -	157
- -	155
- - -	150

es many particulars worthy
ace it is remarkable, that of
f which are of known and
manure hitherto of an am-
to them all, one only ex-
d in combination with other
ssfully applied in union with
graves, no other manure
t. Possibly its deteriorating
y be owing to its antiseptic
utrefactive process by which
animal

animal substances undergo the changes necessary to qualify them to become the food of plants. This, however, I cannot, from any appearance in the soil when the plants were taken up, assert to have been the case.

The extraordinary effects of salt, when combined with soot, are strikingly singular. There is no reason to suppose these effects were produced by any known chemical agency of soot or salt on each other. Were I to guess at the producing cause, I should conjecture it to be that property of saline substances by which they attract moisture from the atmosphere; for I observed those beds where salt had been used were visibly and palpably moister than the rest, even for weeks after the salt had been applied; and this appearance continued till rain fell, when of course the distinction ceased. This property of attracting moisture had greater influence possibly on the soot than on any of the other manures, as soot, from its acrid and dry nature, may be supposed to require a greater proportion of water to dilute it than those substances which contain water already. It may be proper to observe, that on those beds where salt had been used the plants were obviously of a paler green than on the rest, though not less luxuriant; a circumstance which I thought worth noticing, and which I considered, though erroneously (as appeared by the event), to indicate a want of vigour, which would be felt in the crop. It was observable also, that where salt was applied, whether by itself, or in combination, the roots were free from that scabbiness which oftentimes infects potatoes, and from which none of the other beds (and there were in the field nearly forty more than what made part of these experiments) were altogether exempt.

Two sets of experiments, and with the same proportions of manures, were tried with turnips and buck-wheat, on a soil the poorest I could meet with, which produced only a dwarf heath and lichen, and which I had had pared off. The poverty of this soil will appear by the following analysis:

	Grains.
400 grains gave of siliceous sand - -	320
Of finely divided matter, which appeared as brown mould - - - -	68
Loss in water - - - -	12
	400

The finely divided matter lost by incineration nearly half

contained a great deal of vege-
ı principally a mixture of alu-
coloured red by oxide of iron,
lcareous matter. There were
ım or phosphate of lime.
t apart for each set of experi-
ı with turnips and buck-wheat.
4, 5, 6, 7, 19, 20, 21, 22,
marks of vegetation. The re-
eed-leaf.
four only were alive, and in

ulphuric acid.

ım, peat.
sickly existence till the middle
which they all disappeared.—
turnips and buck-wheat were
thought it necessary to notice
ı them, which could not have
into a minute detail, equally

can probably be drawn from
s respecting the advantages or
nure, on such a soil as I have
ıures of acknowledged efficacy
salt; yet this inference, how-
m (and that not an unimpor-
ıe texture and consistence in
existence and health of vege-
are sustained by; and this ap-
ority, such as it was, of those
tributed in any degree to im-
ence.
here these experiments were
y confirms this observation.
reat part of it was in a state
lly barren as the spot I have
ver, now brought into culti-
te of fertility, chiefly from its
d by a thick coating of marly

lt, when mixed with the food
xperiments on sheep, as I did
ited experiments would either
throw

throw new light upon a subject which has already been sufficiently discussed, as applied to those animals, or furnish the public with facts of which it is not already in possession. My experiments have therefore been confined to hogs and cows.

On July 23d, 1804, three hogs of the same litter, about eight months old, were put up to fatten. Their respective weights were as follow:

No. 1. 44 lbs.
2. 47 lbs.
3. 40 lbs.

From the 23d of July till the 7th of August they were fed with barley-meal mixed up with water; during which time they consumed three bushels and a half of barley, and gained in weight as follows:

No. 1. 12 lbs.
2. 10 lbs.
3. 5 lbs.

From the 3d of August to the 21st, they had salt mixed with their food, of which they consumed one quarter of a pound per day. The food consumed was four bushels: they had gained upon the last weighing as under:

No. 1. 18 lbs.
2. 22 lbs.
3. 14 lbs.

From the 21st of August to the 3d of September the salt was discontinued, in which time they ate four bushels and a half of barley-meal; and their increase of weight was,

No. 1. 24 lbs.
2. 21 lbs.
3. 21 lbs.

From the 3d of September to the 17th they had salt as before, and their consumption of food was the same as during the last fortnight, namely, four bushels and a half of barley-meal. Their gain of weight was,

No. 1. 31 lbs.
2. 19 lbs.
3. 19 lbs.

They were then slaughtered.

It did not appear that the salt had any operation either in promoting thirst or stimulating their appetites, the consumption of food being nearly the same whether salted or not; neither does it appear that the salt had any influence on their fattening; perhaps the quantity allowed them was too little; and yet I should think not, as there was enough to food sufficiently savoury to the

it will be observed, that I did
ogs to salt, and another to un-
trying experiments is always
requently particular habits and
animals which will vary the
ng uniform. The fairest way,
liable to error, is to compare
by feeding him at one period
then, for an equal period, with
hich I have proceeded upon be
iese experiments to encourage
g salt to hogs with a view at
ncy to fatten; how far it may
health is a different question,
ience may probably be neces-
ipon this subject I shall men-
rom the object of this essay),
rs which hogs are liable to, all
o be more or less accompanied
ly so efficacious as antimony.
obtained its name from the
who had administered it with
it in such quantities to the
poison them: a circumstance
the time into disrepute as a
al as the metaphorical hogs.
ther true or false, induced me
n hogs; and I can safely aver
there are few internal diseases
at will not yield to antimony
t form which I prefer is emetic
pass. I give it in doses from
cording to the age and strength
still larger doses might be given
t recollect a single instance in
suffer from being over-dosed.
tried the effects of antimony
uantity I give may seem to be
the bulk of the hog compared
experience of many years has
no analogy (I mean as far as
e effects of antimony on the
the constitution of inferior

On the 9th of October 1804, my experiments on cows commenced. On that day two Welch heifers, one of which had calved about five months, the other three, were confined to the house, and fed with hay for the space of one fortnight. The hay they consumed during that time was four hundred weight nineteen pounds, and the milk they produced was thirty-six gallons three quarts. They had then, for the next fortnight, salt mixed with their hay, the hay being first slightly moistened with water, and the salt sprinkled over it; in which time they consumed four hundred weight forty-two pounds of hay, and seven pounds of salt. The milk produced was thirty-seven gallons. For the next fortnight, namely, from the sixth to the twentieth of November, the salt was omitted, and their food was four hundred weight and one quarter of hay, and two hundred weight and a half of cabbages. The produce of milk in that space of time was fifty-four gallons three quarts. From the twentieth of November their food was the same as before, with the addition of half a pound of salt per day. The produce of milk was fifty-seven gallons one quart.

It will be recollected, that salt seemed to have no tendency to promote thirst or to increase appetite in the hogs; yet on the cows its effects in one respect were very perceptible, for during the period they had salt they drank three gallons a day each more than at other times.

Salt may possibly promote digestion, notwithstanding its antiseptic quality, by stimulating the salival glands and the glands yielding the gastric juice, and by inducing an increased discharge of their respective fluids, so necessary to the solubility of the different substances received into the stomach before they can be admitted into the lacteals.

Though there may be nothing in the foregoing experiments to lead us to suppose that salt has any otherwise a tendency to promote a disposition in animals to fatten than as it may contribute to their health by aiding their digestion, yet it is probable that, when administered to animals yielding milk, it may contribute in some small degree to increase that secretion; and this it may do by promoting thirst, which induces the animal to drink copiously; in consequence of which the secretion of milk, as well as all other secretions of the fluids, may be augmented. Perhaps also it may have a stimulating influence on the lacteals themselves.

And yet, after all, admitting these experiments to prove that salt increases in some small degree the production of milk,

d quantity is balanced against the
man will find himself no gainer.
seem any thing in these experi-
cows, to encourage the practice
ith a view to increase their dis-
vould be temerity to affirm that
om the avidity with which most
nivorous animals, whether in a
herwise, are known to eat salt
way, it is reasonable to conclude
been implanted in them in vain.
its salutary effects may be sup-
(as was hinted at before) from
l an increased secretion of fluids,
t may have on the animal œco-
n experimenter more successful
in.

---

ils, as connected with their Im-
REY DAVY, *Esq. F.R.S. Pro-*
e Board of Agriculture and to

relating to the Analysis of Soils.

ng lands are immediately con-
of the chemical nature of soils,
composition appear capable of

ubject has been already felt by
of science; many useful facts
d to it have been furnished by
amined by Lord Dundonald, in
n of chemistry with agriculture,
xcellent essay on manures: but
being exhausted, and new me-
almost continually offered, in
ogress of chemical discovery.
shall have the honour of laying
of those methods of analysing
cise and simple, and most likely
farmer; they are founded part-
gentlemen whose names have

---

s to the Board of Agriculture.

been just mentioned, and partly upon some later improvements.

II. *Of the Substances found in Soils.*

The substances which are found in soils, are certain mixtures or combinations of some of the primitive earths, animal and vegetable matter in a decomposing state, certain saline compounds, and the oxide of iron. These bodies always retain water, and exist in very different proportions in different lands; and the end of analytical experiments is the detection of their quantities and mode of union.

The earths found in common soils are principally silex, or the earth of flints, alumine, or the pure matter of clay, lime, or calcareous earth, and magnesia.

Silex, or the earth of flints, when perfectly pure, appears in the form of a white powder, which is incombustible, infusible, insoluble in water, and not acted upon by common acids; it is the substance which constitutes the principal part of rock crystal; it composes a considerable part of hard gravelly soils, of hard sandy soils, and of hard stony lands.

Alumine, or pure clay, in its perfect state is white like silex; it adheres strongly to the tongue, is incombustible, insoluble in water, but soluble in acids, and in fixed alkaline menstrua. It abounds most in clayey soils and clayey loams; but even in the smallest particles of these soils it is usually united to silex and oxide of iron.

Lime is the substance well known in its pure state under the name of quicklime. It always exists in soils in combination, and that principally with fixed air or carbonic acid; when it is called carbonate of lime; a substance which in the most compact form constitutes marble, and in its looser form chalk. Lime, when combined with sulphuric acid (oil of vitriol), produces sulphate of lime (gypsum), and with phosphoric acid, phosphate of lime. The carbonate of lime, mixed with other substances, composes chalky soils and marles, and it is found in soft sandy soils.

Magnesia, when pure, appears as white, and in a lighter powder, than any of the other earths; it is soluble in acid, but not in alkaline menstrua; it is rarely found in soils; when it does exist, it is either in combination with carbonic acid, or with silex and alumine.

Animal decomposing matter exists in very different states, according as the substances from which it is produced are different; it contains much carbonaceous substance,

cipally resolved by heat into this
, inflammable aëriform products,
rincipally found in lands that have

matter is likewise very various in
more carbonaceous substance than
ers from it in the results of its de-
in not producing volatile alkali;
n of all peats; it abounds in rich
larger or smaller quantities in all

found in soils are very few, and
t they are rarely to be discovered.
iate of soda (common salt), sul-
m salt), and muriate and sulphate
e, and the mild alkalies.
e same with the rust produced by
nd water; it is found in all soils,
yellow and red clays, and in yel-
ls.
nt of these different substances
vith the object of this paper. A
properties and agencies may be
books on chemistry, and particu-
mistry by Dr. Thomson (2d ed.);
f Chemistry.

red for the Analysis of Soils.

struments required for the analysis
little expensive. They are a ba-
g a quarter of a pound of com-
urning when loaded with a grain;
quarter of a pound troy to a grain;
coarse to admit a pepper-corn
Argand lamp and stand; some
crucibles; porcelain or queen's
a Wedgewood pestle and mortar;
a sheet of blotting-paper, folded
liquid, and greased at the edges;
atus for collecting and measuring

es or reagents required for sepa-
s of the soil, are muriatic acid
acid, pure volatile alkali dissolved
iate of potash, soap lye, solution
, of muriate of ammonia, solu-
tion

tion of neutral carbonate of potash, and nitrate of ammonia. An account of the nature of these bodies, and their effects, may be found in the chemical works already noticed; and the reagents are sold, together with the instruments mentioned above, by Mr. Knight, Foster Lane, Cheapside, arranged in an appropriate chest.

IV. *Mode of collecting Soils for Analysis.*

In cases when the general nature of the soil of a field is to be ascertained, specimens of it should be taken from different places, two or three inches below the surface, and examined as to the similarity of their properties. It sometimes happens, that upon plains the whole of the upper stratum of the land is of the same kind, and in this case one analysis will be sufficient; but in valleys, and near the beds of rivers, there are very great differences, and it now and then occurs that one part of a field is calcareous, and another part siliceous; and in this case, and in analogous cases, the portions different from each other should be separately submitted to experiment.

Soils, when collected, if they cannot be immediately examined, should be preserved in phials quite filled with them, and closed with ground glass stoppers.

The quantity of soil most convenient for a perfect analysis is from two to four hundred grains. It should be collected in dry weather, and exposed to the atmosphere till it becomes dry to the touch.

The specific gravity of a soil, or the relation of its weight to that of water, may be ascertained by introducing into a phial, which will contain a known quantity of water, equal volumes of water and of soil; and this may be easily done by pouring in water till it is half full, and then adding the soil till the fluid rises to the mouth; the difference between the weight of the soil and that of the water will give the result. Thus, if the bottle contains four hundred grains of water, and gains two hundred grains when half filled with water and half with soil, the specific gravity of the soil will be two, that is, it will be twice as heavy as water; and if it gained one hundred and sixty-five grains, its specific gravity would be 1825, water being 1000.

It is of importance that the specific gravity of a soil should be known, as it affords an indication of the quantity of animal and vegetable matter it contains; these substances being always most abundant in the lighter soils.

The other physical properties of soils should likewise be examined before the analysis is made, as they denote, to a

certain

mposition, and serve as guides in
ts. Thus, siliceous soils are gene-
1, and scratch glass when rubbed
ls adhere strongly to the tongue,
smell when breathed on; and cal-
nd much less adhesive than alumi-

ing the Quantity of Water of rption in Soils.

s they can be made by continued
cases still contain a considerable
h adheres with great obstinacy to
d vegetable matter, and can only
by a considerable degree of heat.
ysis is, to free the given weight of
his water as possible, without, in
its composition; and this may be
en or twelve minutes over an Ar-
n of porcelain, to a temperature
; and in case a thermometer is not
nay be easily ascertained, by keep-
ontact with the bottom of the dish:
f the wood remains unaltered, the
out when the wood begins to be
ust be stopped. A small quantity
emain in the soil even after this
affords useful comparative results;
ure were employed, the vegetable
undergo decomposition, and in
ent be wholly unsatisfactory.
n the process should be carefully
r hundred grains of soil it reaches
ay be considered as in the greatest
entive of water, and will generally
rge proportion of aluminous earth.
m 20 to 10, the land may be con-
sorbent and retentive, and the sili-
dant.

of Stones, Gravel, and vegetable es from Soils.

es, gravel, or large vegetable fibres

---

which this process has been carried on by
ater that came over pure, and no sensible
was produced.

should be divided from the pure soil till after the water is drawn off; for these bodies are themselves often highly absorbent and retentive, and in consequence influence the fertility of the land. The next process, however, after that of heating, should be their separation, which may be easily accomplished by the sieve, after the soil has been gently bruised in a mortar. The weights of the vegetable fibres or wood, and of the gravel and stones, should be separately noted down, and the nature of the last ascertained: if calcareous, they will effervesce with acids; if siliceous, they will be sufficiently hard to scratch glass; and if of the common aluminous class of stones, they will be soft, easily scratched with a knife, and incapable of effervescing with acids.

VII. *Separation of the Sand and Clay, or Loam, from each other.*

The greater number of soils, besides gravel and stones, contain larger or smaller proportions of sand of different degrees of fineness; and it is a necessary operation, the next in the process of analysis, to detach them from the parts in a state of more minute division, such as clay, loam, marle, and vegetable and animal matter. This may be effected in a way sufficiently accurate, by agitation of the soil in water. In this case, the coarse sand will generally separate in a minute, and the finer in two or three minutes; whilst the minutely divided earthy, animal, or vegetable matter will remain in a state of mechanical suspension for a much longer time; so that, by pouring the water from the bottom of the vessel, after one, two, or three minutes, the sand will be principally separated from the other substances, which, with the water containing them, must be poured into a filter, and, after the water has passed through, collected, dried and weighed. The sand must likewise be weighed, and their respective quantities noted down. The water of lixiviation must be preserved, as it will be found to contain the saline matter, and the soluble animal or vegetable matters, if any exist in the soil.

VIII. *Examination of the Sand.*

By the process of washing and filtration, the soil is separated into two portions, the most important of which is generally the finely divided matter. A minute analysis of the sand is seldom or never necessary, and its nature may be detected in the same manner as that of the stones or gravel. It is always either siliceous sand, or calcareous sand,

oth. If it consist wholly of car-
be rapidly soluble in muriatic acid,
if it consist partly of this sub-
iceous matter, the respective quan-
by weighing the residuum after
hich must be applied till the mix-
taste, and has ceased to effervesce.
liceous part: it must be washed,
ly in a crucible: the difference be-
and the weight of the whole, indi-
alcareous sand.

e finely divided Matter of Soils, ing mild Lime and Magnesia.

tter of the soil is usually very com-
sometimes contains all the four
s, as well as animal and vegetable
the proportions of these with to-
ost difficult part of the subject.
performed, in this part of the ana-
the fine matter of the soil to the
acid. This substance should be
matter in an evaporating bason, in
the weight of the earthy matter;
ts volume of water. The mixture
and suffered to remain for an hour
fore it is examined.
ne or of magnesia exist in the soil,
lved in this time by the acid, which
ise a little oxide of iron; but very

passed through a filter; the solid
with rain water, dried at a mode-
Its loss will denote the quantity
The washings must be added to
ot sour to the taste, must be made
h acid, when a little solution of
ash must be mixed with the whole.
curs, it denotes the presence of
solution of the prussiate must be
effect is produced. To ascertain
collected in the same manner as
and heated red: the result is oxide

om oxide of iron, a solution of
potash must be poured till all ef-

fervescence ceases in it, and till its taste and smell indicate a considerable excess of alkaline salt.

The precipitate that falls down is carbonate of lime; it must be collected on the filter, and dried at a heat below that of redness.

The remaining fluid must be boiled for a quarter of an hour, when the magnesia, if any exist, will be precipitated from it, combined with carbonic acid, and its quantity is to be ascertained in the same manner as that of the carbonate of lime.

If any minute proportion of alumine should, from peculiar circumstances, be dissolved by the acid, it will be found in the precipitate with the carbonate of lime, and it may be separated from it by boiling for a few minutes with soap lye, sufficient to cover the solid matter. This substance dissolves alumine, without acting upon carbonate of lime.

Should the finely divided soil be sufficiently calcareous to effervesce very strongly with acids, a very simple method may be adopted for ascertaining the quantity of carbonate of lime, and one sufficiently accurate in all common cases.

Carbonate of lime, in all its states, contains a determinate proportion of carbonic acid, *i. e.* about 45 per cent.; so that when the quantity of this elastic fluid, given out by any soil during the solution of its calcareous matter in an acid, is known, either in weight or measure, the quantity of carbonate of lime may be easily discovered.

When the process by diminution of weight is employed, two parts of the acid and one part of the matter of the soil must be weighed in two separate bottles, and very slowly mixed together till the effervescence ceases; the difference between their weight before and after the experiment denotes the quantity of carbonic acid lost; for every four grains and a half of which, ten grains of carbonate of lime must be estimated.

The best method of collecting the carbonic acid, so as to discover its volume, is by the pneumatic apparatus, the construction and application of which are described at the end of this paper. The estimation is, for every ounce measure of carbonic acid, two grains of carbonate of lime.

X. *Mode of ascertaining the Quantity of insoluble finely divided Animal and Vegetable Matter.*

After the fine matter of the soil has been acted upon by muriatic acid, the next process is to ascertain the quantity of finely divided insoluble animal and vegetable matter that it contains.

fficient precision, by heating it
ible over a common fire till no
ss. It should be often stirred
to expose new surfaces continu-
veight that it undergoes denotes
nce that it contains destructible

rtain whether this substance is
e matter, or a mixture of both.
ring the incineration is similar
is a certain indication of some
us blue flame at the time of ig-
tes a considerable proportion of
when the experiment is needed
ed, the destruction of the de-
be assisted by the agency of ni-
at the time of ignition, may be
heated mass, in the quantity of
undred of residual soil. It af-
to the combustion of the animal
h it causes to be converted into
lf at the same time decomposed

luminous and Siliceous Matter
ide of Iron.

g after the decomposition of the
r, are generally minute particles
g usually alumine and silex with

each other, the solid matter
three hours with sulphuric acid,
weight of water; the quantity
ted by the quantity of solid re-
wing for every hundred grains
d and twenty grains of acid.
after the action of the acid may
and it must be separated and its
vashing and drying in the usual

xide of iron, if they exist, are
uric acid; they may be separa-
nia, added to excess; it throws
es the oxide of iron in solu-
ay be separated from the liquid

Should any magnesia and lime have escaped solution in the muriatic acid, they will be found in the sulphuric acid: this, however, is scarcely ever the case; but the process for detecting them, and ascertaining their quantities, is the same in both instances.

The method of analysis by sulphuric acid is sufficiently precise for all usual experiments; but if very great accuracy be an object, dry carbonate of potash must be employed as the agent, and the residuum of the incineration must be heated red for half an hour, with four times its weight of this substance, in a crucible of silver, or of well baked porcelain. The mass obtained must be dissolved in muriatic acid, and the solution evaporated till it is nearly solid; distilled water must then be added, by which the oxide of iron and all the earths, except silex, will be dissolved in combination as muriates. The silex, after the usual process of lixiviation, must be heated red; the other substances may be separated in the same manner as from the muriatic and sulphuric solutions.

This process is the one usually employed by chemical philosophers for the analysis of stones.

XII. *Mode of discovering soluble Animal and Vegetable Matter, and Saline Matter.*

If any saline matter, or soluble vegetable or animal matter, is suspected in the soil, it will be found in the water of lixiviation used for separating the sand.

This water must be evaporated to dryness in an appropriate dish, at a heat below its boiling point.

If the solid matter obtained is of a brown colour and inflammable, it may be considered as partly vegetable extract. If its smell, when exposed to heat, be strong and fœtid, it contains animal mucilaginous or gelatinous substance; if it be white and transparent, it may be considered as principally saline matter. Nitrate of potash (nitre), or nitrate of lime, is indicated in this saline matter, by its scintillating with a burning coal. Sulphate of magnesia may be detected by its bitter taste; and sulphate of potash produces no alteration in solution of carbonate of ammonia, but precipitates solution of muriate of barytes.

XIII. *Mode of detecting Sulphate of Lime (Gypsum) and Phosphate of Lime in Soils.*

Should sulphate or phosphate of lime be suspected in the entire soil, the detection of them requires a particular

weight of it, for instance four
eated red for half an hour in a
hird of powdered charcoal. The
a quarter of an hour, in a half-
collected through the filter, and
he atmosphere in an open vessel.
sulphate of lime (gypsum) ex-
ecipitate will gradually form in
f it will indicate the proportion.
ny exist, may be separated from
r gypsum. Muriatic acid must
in quantity more than sufficient
hs; the solution must be evapo-
on the solid matter. This fluid
ds of earths with the muriatic
ate of lime untouched.
the limits assigned to this paper,
he detection of substances which
with the matters of soils. Man-
und in them, and compounds of
e bodies appear to bear little re-
enness, and the search for them
nuch more complicated, without

f Results and Products.

of a soil is completed, the pro-
d their quantities added together;
he original quantity of soil, the
as accurate. It must however
phate or sulphate of lime are dis-
ent process XIII., a correction
ral process, by subtracting a sum
m the quantity of carbonate of
ion from the muriatic acid.
cts, the form should be in the
y which they were obtained.
ood siliceous sandy soil may be

	Grains.
- - -	18
el, principally siliceous,	42
getable fibres -	10
- - -	200
	270

Brought

		Grains.
Brought over		270
Of minutely divided matter separated by filtration, and consisting of		
Carbonate of lime	25	
Carbonate of magnesia	4	
Matter destructible by heat, principally vegetable,	10	
Silex	40	
Alumine	32	
Oxide of iron	4	
Soluble matter, principally sulphate of potash and vegetable extract,	5	
Gypsum	3	
Phosphate of lime	2	
		125
Amount of all the products		395
Loss		5

In this instance the loss is supposed small; but in general, in actual experiments, it will be found much greater, in consequence of the difficulty of collecting the whole quantities of the different precipitates; and when it is within thirty for four hundred grains, there is no reason to suspect any want of due precision in the processes.

XV. *This general Method of Analysis may in many Cases be much simplified.*

When the experimenter is become acquainted with the use of the different instruments, the properties of the reagents, and the relations between the external and chemical qualities of soils, he will seldom find it necessary to perform, in any one case, all the processes that have been described. When his soil, for instance, contains no notable proportion of calcareous matter, the action of the muriatic acid IX. may be omitted. In examining peat soils, he will principally have to attend to the operation by fire and air X.; and in the analysis of chalks and loams, he will often be able to omit the experiment by sulphuric acid XI.

In the first trials that are made by persons unacquainted with chemistry, they must not expect much precision of result. Many difficulties will be met with; but, in overcoming them, the most useful kind of practical knowledge will be obtained; and nothing is so instructive in experimental science as the detection of mistakes. The correct analyst

ounded in chemical information;
tter mode of gaining it, than that
estigations. In pursuing his ex-
ntinually obliged to learn from
bstances he is employing or act-
ical ideas will be more valuable in
ctical operation, and acquired for

t of Soils, as connected with the
their Composition.

soil is examined with a view to
t in all cases, if possible, to be
ly fertile soil in the same neigh-
r situation: the difference given
icate the methods of cultivation;
vement would be founded upon
es.

ned a large quantity of sand, in
soil, the process of amelioration
a supply of this substance; and
lly simple with regard to soils de-
s matter.

, sand, loam, marle, or chalk, to
lar chemical principles to be ob-
me is used, great care must be
d from the magnesian limestone;
n shown by Mr. Tennant, it is
nd*. The magnesian limestone
n the common limestone by its
e length of time that it requires
d it may be analysed by the pro-
and magnesia IX.

mparison indicates an excess of
use of sterility, it may be de-
zation and exposure to air, by
e agency of lately made quick-
nimal and vegetable matter must
egetable manure.

fferent Climates and Situations
in Composition.

s of fertility and barrenness, as
ents, must necessarily differ in

. 305. This limestone is found abundantly
mersetshire.

different climates, and under different circumstances. The power of soils to absorb moisture, a principle essential to their productiveness, ought to be much greater in warm and dry countries than in cold and moist ones; and the quantity of fine aluminous earth they contain larger. Soils likewise that are situated on declivities ought to be more absorbent than those in the same climate on plains or in valleys*. The productiveness of soils must likewise be influenced by the nature of the subsoil, or the earthy or stony strata on which they rest; and this circumstance ought to be particularly attended to, in considering their chemical nature, and the system of improvement. Thus, a sandy soil may sometimes owe its fertility to the power of the subsoil to retain water; and an absorbent clayey soil may occasionally be prevented from being barren, in a moist climate, by the influence of a substratum of sand or gravel.

XVIII. *Of the chemical Composition of fertile Corn Soils in the Climate.*

Those soils that are most productive of corn contain always certain proportions of aluminous and calcareous earth in a finely divided state, and a certain quantity of vegetable or animal matter.

The quantity of calcareous earth is however very various, and in some cases exceedingly small. A very fertile corn soil from Ormiston in East Lothian afforded me in a hundred parts, only eleven parts of mild calcareous earth; it contained twenty-five parts of siliceous sand; the finely divided clay amounted to forty-five parts. It lost nine in decomposed animal and vegetable matter, and four in water, and afforded indications of a small quantity of phosphate of lime.

This soil was of a very fine texture, and contained very few stones or vegetable fibres. It is not unlikely that its fertility was in some measure connected with the phosphate; for this substance is found in wheat, oats, and barley, and may be a part of their food.

A soil from the low lands of Somersetshire, celebrated for producing excellent crops of wheat and beans without manure, I found to consist of one-ninth of sand, chiefly siliceous, and eight-ninths of calcareous marle tinged with iron, and containing about five parts in the hundred of vegetable matter. I could not detect in it any phosphate or sulphate of lime; so that its fertility must have depended

---

* Kirwan. Trans. Irish Academy, vol. v. p. 175.

of attracting principles of vege-
ter and the atmosphere*.
eriments made on the composi-
d that a soil composed of three-
s of river sand, and three-eighths
, was very proper for wheat.

of Soils proper for bulbous Roots
for Trees.

ts require a soil much more sandy
e grasses. A very good potatoe
all, afforded me seven-eighths of
sorbent power was so small, that
ly two by drying at 400 Fahren-

ts of which are fibrous and hard,
deep into the earth, will vegetate
common soils which are mode-
ot contain a very great excess of

rom a field at Sheffield-place in
ducing flourishing oaks, to con-
d one part of clay and finely di-
hundred parts of the entire soil,
duced

	Parts.
- - -	3
- - -	54
- - -	28
- - -	3
- - -	5
able matter -	4
- - -	3

vements made by changing the
e earthy Parts of Soils.

e of the causes that influence the
t is obvious that, in the present
system can be devised from their
t of experiment: but there are
ur of analytical trials will not be
nty with which they denote the
tion; and this will particularly

Poole, Esq. of Nether Stowey. It is near
o the British Channel; but, I am told, is

happen when the defect of composition is found in the proportions of the primitive earths.

In supplying animal or vegetable manure, a temporary food only is provided for plants, which is in all cases exhausted by means of a certain number of crops; but when a soil is rendered of the best possible constitution and texture, with regard to its earthy parts, its fertility may be considered as permanently established. It becomes capable of attracting a very large portion of vegetable nourishment from the atmosphere, and of producing its crops with comparatively little labour and expense.

Description of the Apparatus for the Analysis of Soils. See Plates II. and III.

A. Retort.

B. B. Funnels for the purpose of filtrating.

D. Balance.

E. Argand's lamp.

F, G, H, K. The different parts of the apparatus required for measuring the quantity of elastic fluid given out during the action of an acid on calcareous soils. F represents the bottle for containing the soil. K. The bottle containing the acid furnished with a stopcock. G. The tube connected with a flaccid bladder. I. The graduated measure. H. The bottle for containing the bladder. When this instrument is used, a given quantity of soil is introduced into F; K is filled with muriatic acid diluted with an equal quantity of water; and the stopcock being closed is connected with the upper orifice of F, which is ground to receive it. The tube G is introduced into the lower orifice of F, and the bladder connected with it placed in its flaccid state into H, which is filled with water. The graduated measure is placed under the tube of H. When the stopcock of K is turned, the acid flows into F, and acts upon the soil; the elastic fluid generated passes through G into the bladder, and displaces a quantity of water in H equal to it in bulk, and this water flows through the tube into the graduated measure; the water in which gives by its volume the indication of the proportion of carbonic acid disengaged from the soil; for every ounce measure of which two grains of carbonate of lime may be estimated.

L. Represents the stand for the lamp.

M, N, O, P, Q, R, S. Represent the bottles containing the different reagents.

oir on the Steeping of Wool, and
lifferent States on Dyeing. By
or of the Dyeing Establishment
tories. Read in the French Na-

labours of Dufay, of Hellot, of
tant investigations of Messrs.
eing still presents a great num-
e difficult to be resolved, owing
f its agents. Besides the effects
the primary substances, by the
aloric, and by the degree of at-
principles for vegetable and ani-
which exist in the state of the
ion very remarkable alterations.
with the superintendance of the
he imperial manufactories, has
ools of various qualities, sub-
nts, were coloured in a manner
ever he was desirous of forming
. These differences in the de-
uring particles are owing to a
of which he intends to treat in

ularly excited his astonishment
ools perfectly alike in their ex-
med in the same vat very dif-
the greater importance to in-
is difference, as dyeing, whose
arts is so powerful, is the basis
estry; and as the slightest error
ur renders it totally useless and
ess in the choice of colours is
erved in the manufactory of the
he exertions of M. Guillaumot,
erance in destroying deep-rooted
hat establishment to such a de-
fection, that the pictures of the
re transferred to its productions
e and astonishing. The execu-
r that manufacture is at present
difficulties, because, instead of

les de Chimie, No. 158.

operating, as formerly, with a series of colours taken as it were at random, it is necessary to find precisely the shade required, to follow the insensible gradation from light to dark through an harmonious succession of thirty or forty colours. But how can a dyer, however he may be accustomed to all the operations of this kind, be sure of obtaining invariable results, when, besides a multitude of well known causes, minute differences in the degree of twisting alter the affinity of the light, and when the least mixture in the substances to be dyed causes a considerable variation in the affinity for the colouring principle? Previous experiments made on the wool of animals in different states, caused M. Roard to imagine that a more extensive investigation of the subject would make him acquainted with the cause of the changes he had before observed.

M. Tessier, to whom agriculture owes such important improvements, facilitated his researches by procuring him fleeces of Merinos in the grease from animals in health, diseased, and such as had died of the rot.

The wools of the healthy, dead, and diseased animals, corresponding to the numbers 1, 2, 3, were employed separately, together, and mixed with scrapings (*pelure*), wool of very inferior quality, and which has besides been altered by lime.

Scouring and bleaching are so intimately connected with the operations of dyeing, that the author thought fit to begin his comparative observations with these preliminary processes, and even to extend them to the grease, the constituent principles of which were precisely explained in M. Vauquelin's memoir on the nature of that substance.

The agents which he employed for scouring wool, either in the fleece or spun, are: 1. Grease; 2. Soap; 3. Caustic potash; 4. Hot water; 5. Boiling water; 6. Flanders soap.

1. These wools being treated separately, according to the universal custom, were not completely freed from grease. No. 1. was very white, perfectly free from all impurity, without the smell of sheep; but, on rubbing it between the fingers, a matter somewhat greasy might be perceived. The wool of the beast No. 2, which had died of the rot, was extremely dirty, charged with earth and animal matters: after being scoured it had still a yellowish gray colour, some smell, and was more greasy than the preceding. In the fleece of No. 3, attacked with a languid disease, were a great quantity of ticks. That insect had not a little contributed to aggravate the disease of the animal, whose soft, weak

enish yellow colour, which di-
ıy.
ol of each of the preceding num-
th 1-20th of soap, became very
from the grease: it had a very
e to the air speedily removed.
austic potash scours and whitens
this method, though very effica-
many inconveniences to advise

ne time in hot water lost, by the
little of its greasy matter to be

the operations of scouring to
fluid above 60°, or to leave the
arter of an hour, for it is liable
boiling water.
substance which appeared to act
anner; it scours very speedily,
whiteness which it is extremely
other means.
n in the grease and afterwards
d before it was spun, it ap-
become exceedingly white, re-
rought cotton, while the second
t, from which it can never be
nt frequently repeated, and in
tantly afforded the same results.
ideas current in the work-shops,
n never be thoroughly cleansed
reat part of the preparations it
never fixed in a solid manner.
e of sparing proprietors an ope-
ecute perfectly, a twofold cause
reserve wool in the grease: in
from insects and grubs, which
te; and in the second, to allow
ploy white wool the means of
tre which it can never acquire
scoured.
phuric acid were likewise tried;
was capable of giving to wool,
egree of whiteness as to that
freed from grease at once.
d to ascertain a fact which he
had

had long before observed; namely, that whiteness, so far from being the same in substances belonging to different classes, varies even in the produce of the same class: thus, the white of cotton will never be the same as that of thread, and a difference will always be perceived between the whiteness of wool and that of silk, in the same manner as we distinguish, though with greater difficulty, the numerous products of individuals of the same family. For it cannot be doubted that, if even the same disposition of the surfaces could establish between all these bodies a certain identity for reflecting the light; yet, as the smallest difference of their nature must affect their affinity, this alone would be sufficient to produce alterations in them.

The intention of these researches was to ascertain the influence which the state of the animal must exercise over the grease, and the nature of the wool.

The grease is a fatty, unctuous substance, with a very strong smell, which is supplied in the sheep by sweat, and the transpirable matter emitted by all animals. When dissolved in water, and filtered to disengage it from the earthy and animal matters which adhere to it, it is of a beautiful yellow fawn colour, more or less inclined to red, and composed, according to M. Vauquelin, of a soap with a basis of potash, animal matter, lime, and potash, combined with carbonic, acetic, and muriatic acids. Filtration likewise separates a white matter floating on the surface of the grease, and which in scouring does not combine with the alkalies: it appears to be of the same nature as suet; it melts, and becomes liquid, at a low temperature, and takes fire very easily.

The animal matter dissolved by alkalies is precipitated of a reddish yellow by all the acids. Oxygenated muriatic acid and oxygenated muriatic acid gas form in it a white flaky precipitate, which becomes coloured by exposure to the air: it is a kind of paste, soft, somewhat viscous, of a dirty yellow colour; it speedily becomes liquid, and burns with a bright white flame. This matter, when kept for some hours at eighty degrees, in several pounds of water, is totally insoluble; but by evaporating the liquid you obtain a small quantity of a soft matter, of a dark brown colour, which has an agreeable smell, resembling that of the extract of liquorice. He was the less surprised to find this smell in the grease, as in his experiments made in the year 1800, by which he first demonstrated the presence of potash in it, he remarked that ammonia, kept in digestion with this substance, gave it a strong smell of orange flowers,

and

riters who treat of the medical
d its fœtid smell, agree that after
es to an agreeable odour, resem-

e animal matter takes up a re-
yellow colour, which is precipi-
light yellow, by water and by

ng the yellow extremities of the
nder the belly and the thighs of
n with alcohol, quicklime, and
of these agents was capable of
appears that the grease accumu-
her with the action of the air,
mbination, which cannot be de-
eir texture.
ase, Nos. 1, 2, 3, at the same
re filtered and evaporated nearly
rcelain. No. 1. furnished twice
others; it strongly attracted the
became almost entirely liquefied
hree in the same manner, pro-
rvescence. After burning them
separated from all three, by di-
cid, potash slightly carbonated,
ight of which was more consi-
and 3, which exhibited no very

monstrating that the grease and
onent principles, increase or de-
rding to their state of health or
ise to form a judgment of the
bstance to these different states,
e beauty of their products. For
to look upon it as prejudicial to
the augmentation of this secre-
the health of the animals, as
, Tessier, and Huzard, in their
of long wools; and when the
gree in rejecting every method
f it, such as exposing them to
heir backs. Besides, does not
ost distinguished of all the spe-
neness and the beauty of its rich
ntity of grease? and do we not
ng with the quality of the wool,
and

and dwindling to nothing in those of the same species that are covered with hair, as the sheep of Guinea and Senegal?

As M. Roard cannot at present give his observations all the latitude of which they are susceptible, he hastens to make public the experiments relative to the effects produced in dyeing by the different qualities of the wools he employed.

The colour assumed by wools while steeping appeared to him a fact so interesting, that he thought it necessary to investigate the cause. He alternately changed the vessels and the agents destined for this operation, and ascertained that this coloration ought to be ascribed entirely to the action of copper; for ammonia forms a blue precipitate in steeping vessels of that metal, while the same precipitate is extremely white, if vessels of earth, porcelain, or even tin, be employed. Wool left for some hours in boiling water, in a copper vessel, acquires a greenish gray tint; but this effect is greatly augmented by the ordinary mixture of alum and tartar. If into this bath, saturated and boiling, you plunge different kinds of combed wool, those produced by the native breed of France and Holland assume a lively green colour, and those of Merinos a greenish yellow, or a very dark ochre yellow. Though this effect is much less perceptible in steeps on a large scale, yet, by comparing white wool with that which has been steeped, the difference appears sufficiently striking. The colour fixed by this method is very little altered by alkalies, and not at all by acids, which in a slight degree heighten its intensity: ammonia turns it to a yellowish gray.

In these experiments the author employed alum manufactured by M. Curaudau, which appeared to him to possess all the qualities and defects of Roman alum, in a comparative investigation which he undertook relative to the effects in dyeing of all the kinds sold in the shops.

The wools, after remaining eight days in the alum liquor, were then dyed with cochineal, madder, saunders wood, &c. The same qualities, whether natural or acquired, having appeared to act in the same manner in all the experiments to which they were subjected, M. Roard describes only the first, which was that made with cochineal.

Experiment I.

No. 1. *Healthy Merinos.*

A beautiful carnation red, inclining a little to yellow. This No. 1. surpassed in depth and intensity all the shades which he tried of more than two or three colours.

Experiment

xperiment II.

Animals dead and diseased.

lways the same; sometimes, how-
y coloured. The difference between
nd diseased animals and those of
oth of the same flock, is very re-

xperiment III.

of equal Parts of 1, 2, *and* 3.

ltered wool being much greater in
lours I obtained with it nearly re-
, but never equal in beauty that of

xperiment IV.

s No. 1, *but spun without Oil, and*
rease at a single Operation.

by this wool was more brilliant
its tone was less high; which de-
e operations the natural colouring
e utility. Thus, in fine crimsons,
the silks ought to retain somewhat
se that are white can never acquire
This observation perfectly coincides
f Coulomb on the good effects in
ed with a portion of its colouring

xperiment V.

ings of Wool of Picardy.

er, which forms a part of this wool,
hat it is always clouded: in all the
produced a dull dirty colour, far
. By the mixture of this damaged
erate the quality of all the carded
, as much preparation agrees very
ployed only in the manufacture of

periment VI.

ool of the Merinos No. 1, *in equal*
Parts.

ad quality of the wool No. 6, this
o well, that, in all my experiments,
to that of No. 1, though, owing
arance was always dull.

Experiment

Experiment VII.

Nos. 8 and 9. *Mixtures made with equal Parts of Clippings, the Wool of dead Animals No. 2, and of diseased Sheep No. 3.*

The difference between Nos. 8 and 9 was scarcely perceptible; the colours were dull and dirty, and darker than Nos. 2 and 3, of which they were in part formed.

Experiment VIII.

The same numbers of wool employed in the preceding experiments were dyed blue, and their results perfectly agreed with those already stated. This colour is perhaps the only one that wools of an inferior quality take well, though the blue is not equal, and always inclines to black.

Experiment IX.

The wools Nos. 1 and 2, which had been scoured, and the scrapings, No. 8, were treated with the dye, comparatively with that of No. 1, spun in the grease. The three first took the colour slowly, and assumed a dull blue tint, inclining to black. No. 1, on the contrary, took it very speedily, and acquired a beautiful and very deep blue colour. These four numbers were scoured together, hot, with Flanders soap: the wools of the healthy and dead animals, and the clippings, entirely lost their colour; while that of No. 1, in the grease, retained a very brilliant barbel blue.

Experiment X.

Wools of the three qualities employed in the three manufactories of tapestry were dyed at the same time with the Merino wool No. 1. In all the experiments the latter took a deeper colour than any of the others, which are carded wools of Flanders, Holland, and Picardy.

The principal facts contained in this memoir lead to the following consequences:

1. In scouring, the heat of the fluid ought never to exceed 60°; for, even before it rises to the temperature of boiling water, wools in the grease are very liable to be injured by the potash.

2. Wools scoured at two operations can never be rendered completely white. This effect seems to proceed from a change of state in the greasy colouring matter, which, by becoming more highly oxygenated, loses its solubility.

3. Oxygenated muriatic acid, and oxygenated muriatic acid gas, precipitate, in white flakes, the animal matter contained in the grease: it is speedily coloured by the air, and

e with an agreeable smell, which
nalogous to that developed by am-
scovered in it by the antients.
little surprise to see the quantity
diminish or increase in sheep ac-
disease or of health; for a secretion
ng the utmost exertions of nature,
ately connected with the augmenta-
e vital powers. But how is it pos-
grease has an immediate action on
when we see those two substances
express it, in harmony, from the
the most beautiful and the most
was probably to assist them to re-
spiration, that the Romans, after
with a mixture of tonic and oily
rding to Columella, preserved them
d contributed to render their wools

stantly assume, in copper vessels,
ss deep, which, even at the lowest
revent them from taking the first
effect is obviated by the use of tin
which cannot alter the whiteness of
g.

nts prove that the affinity for the
in wools according to the healthy
nimal; and that the wool of healthy
highly coloured than not only Nos.
roduce of the same flock, but even
ls of France and Holland. They
e ought to ascribe the effects pro-
terior characters of which are per-
, after receiving the same prepara-
me vat, different colours.

l very solid blue colours obtained
ase, demonstrate, in a very positive
of that animal matter, which, if
stances, might furnish the arts with
lications.

tions of the Author.

my memoir to the National Insti-
complete proof of the facts to which
exhibited in dyeing by carded wools.
the different causes which exercised
an

an influence over our operations could not arise from the manipulations of the dyer, we complained to our wool-merchant of the bad quality of his goods. He was then obliged to acknowledge that he mixed the wools of Flanders with those of Holland according to the general practice of the trade; and that, though all the dyers had constantly complained of the same defects, yet, as they had neglected to acquaint him with the cause, he had not been able to take such measures as to prevent them in future. These wools are likewise attended with a disadvantage of another kind, which it is of considerable importance to indicate; I mean the augmentation that is given them by passing them through butter-milk, and which almost always amounts to one-eighth of their weight. They are surcharged with a white dusty matter; which, even after careful and repeated washing, still furnishes a sufficient quantity of acetous acid to change a great number of results in dyeing.

VIII. *New Galvanic Discoveries. By M.* RITTER. *Extracted from a Letter from M.* CHRIST. BERNOULLI[*].

1. *Charging a Louis d'Or by the Pile.*

THE pile with which M. Ritter commonly performs his experiments consists of 100 pairs of plates of metal, two inches in diameter; the pieces of zinc have a rim to prevent the liquid pressed out from flowing away; and the apparatus is insulated by several plates of glass.

As M. Ritter resides at present near Jene, I have not had an opportunity of seeing experiments with his great battery of two thousand pieces, or with his battery of fifty pieces, each thirty-six inches square, the action of which continues very perceptible for a fortnight. Neither have I seen his experiments with the new battery of his invention, consisting of a single metal, and which he calls *the charging pile*.

I have, however, seen him galvanize a louis d'or. He places it between two pieces of pasteboard, thoroughly wetted, and keeps it six or eight minutes in the chain of circulation connected with the pile; and thus the louis becomes charged, though not immediately in contact with the conducting wires. If the louis thus charged be applied to the crural nerves of a frog recently prepared, the usual contractions

---

[*] Abridged from *Van Mons's Journal*, vol. vi.

had put a louis thus galvanised into
r said to me a few minutes after,
ouis from among the rest, by try-
pon the frog. Accordingly I made
tinguished, among several others,
e exciting quality was very evident.
proportion to the time that the
circuit of the pile. Of three dif-
tter charged in my presence, nei-
s than five minutes. These expe-
etely, and nothing seemed so easy

g the galvanic charge, though in
nd with other metals, shows that
e galvanic virtue has more affinity
ith electricity, and assigns io the
diate rank between these two.
way I have just described, charge
pieces. It it only necessary that
f the number communicate with
vention of wet pasteboards. It is
ged in this manner, and placed
eces of wet pasteboard alternately
er constructs his charging pile,
nce of its inventor to be called the
struction of this pile shows, that
his way acquires polarity, as the
l with a magnet. Though I have
ing this new pile, I have convin-
of the phænomenon by an experi-
rtance to science, and for the in-
equally indebted to the same inge-

ous experiments on the excitation
e contact of two different metals,
abandoned the original mode of
er experimentalists, who employ
had perceived not only a very
excitability of the different parts
ference of excitement between the
es, according as the positive or
l to them, or as they were acted
metals were brought into contact
er.
s at its highest point of energy, as
oment after they are prepared, or
in

in adult frogs during the coupling season, the flexors alone contract, and in particular the flexor muscles of that thigh to which the silver or negative metal is applied, contract at the instant when the metals come into contact, while those of the thigh to which the zinc or positive metal is applied, contract at the instant of their separation.—Opposite effects are observable in frogs the excitability of which is on the point of being extinguished (Ritter's fifth degree). In this case the extensors only contract, and the flexors remain absolutely motionless. At the moment of contact of the metals the muscles on the zinc side alone are thrown into action, and at the moment of separation those on the silver side.

M. Ritter distinguishes three degrees of mean excitability. At the second degree (the first of the three mean degrees), when the metals are brought into contact, a strong excitement of the flexors takes place on the silver side, and a weak excitement of the extensors on the zinc side; and when the metals are separated a strong excitement of the flexors is seen on the zinc side, and a weak excitement of the extensors on the silver side.

At the fourth degree of excitability the contrary takes place. At the third or middle degree the excitability appears to be equally distributed, the contractions on each side appearing equal, and at the moment of contact the flexors contract on the silver side, the extensors on the zinc side; while at the moment of separation the extensors contract on the silver side, and the flexors on the zinc side.

All these phænomena were exhibited to me by M. Ritter, and the different contractions were very easy to be distinguished. I have not had time to repeat these experiments, and I fear, easy as they appeared to be, they will require an experienced hand to produce such distinct effects as I witnessed. Even with him, none of the experiments which I saw succeeded the first time.

M. Ritter, after showing me his experiments on the different contractibility of various muscles, made me observe, that the piece of gold galvanised by communication exerts at once the action of two metals, or of one constituent part of the pile; and that the half which in the circle was next the negative pole became positive, and the half towards the positive pole became negative.

Having discovered a way to galvanise metals, as iron is rendered magnetic, and having found that the galvanised metals always exhibit two poles, as the magnetic needle does, M. Ritter suspended a galvanised gold needle on a pivot. He perceived, to his surprise, that these needles

ation, and that the angle of varia-
ch I am sorry I cannot recollect,
in all his experiments. It differs
magnetic needle, and the positive

---

riments. By M. Ritter*.

some time past employed myself
ian in the chemical part of gal-
r, had occasion to make some ob-
epartment. I have, for example,
on an indigo blue extremely beau-
ide you must take a glass tube six
eter of half or three quarters of an
a third or fourth part with mer-
water. Introduce into each end of
ire; place the tube in a somewhat
ake the superior wire communicate
nd the inferior wire with the nega-
hours the surface of the mercury
th a blue oxide of iron. This oxide
f the positive wire, which is par-
ative wire. It deoxidates itself at
nd afterwards into a blue oxide.
product which I obtained is the
ated. This oxide is formed in any
e side of the positive gold wire of
t metallic sound, conducts electri-
edingly well, is very friable, and
ena of iron. It often forms lances
straight, of the length of from 3 to
a line to three-quarters of a line in
ns represent in their whole length a
ted crystals, in the form of andreo-
across the columns gives in some
k cross. I should have much to
ly this product; but an experiment,
tance of the microscope, will afford
it than I could give by description.
, reduced to powder, and thrown into
oduces, even in cold, a very strong
ied with an abundant disengage-

---

n Mons's Journal, No. 17.

ment of oxygenated muriatic acid gas; and converts itself almost instantly into luna cornea. In employing for this experiment crystals instead of powder, there is heard even at a distance a strong crackling.

You can obtain in the same manner very quickly the brown oxide of lead. This oxide takes the shape of a little scooped out channel. It has a very brilliant metallic appearance, and conducts electricity very well. The brown oxide of lead with muriatic acid, even in cold, also throws up vapours of oxygenated muriatic acid, but not nearly in the same abundance as hyperoxide of silver.

Other metals afforded me similar products, but I have not yet had time to examine them.

In like manner as silver allows itself to hyperoxidate, it allows itself to hydrogenate by the pile. You obtain the hydrogenated silver in decomposing by the gold wire, or by the negative silver of the pile, a solution diluted so sufficiently that the disengaged hydrogen shall be in greater quantity than is necessary to deoxidate the silver. The superabundant hydrogen combines with the metal, and forms a composite of the same colour, which deposits itself under the appearance of a black magma, of a spunge-like body, or of beautiful dendritic forms, and which is the true hydrogenated silver.

Priestley knew this substance, and gave it the name of dephlogisticated silver. Bucholz had also obtained it, and regarded it as silver incompletely reduced. But by heat one may disengage hydrogen under the form of gas; after which there remains reduced silver.

I expect to obtain violent detonations from the mutual reaction of hyperoxidated silver and hydrogen. Copper is hydrogenated under the same circumstances, and takes a blue colour, with the most beautiful and various shades.

The same hydrogenation succeeded equally well in my experiments with tin.

I have not yet examined the black precipitate of gold which is obtained at the wire of the negative pole of the pile. Silver, copper, and tin take the highest degrees of hydrogenation by exposure in a very diluted state to strong piles having gold wires from three-quarters of a line to one line in thickness; and the highest degree of hydrogenation, chiefly for silver, appeared to constitute the gaseous state. We know already the gaseous state of the highest degree of hydrogenation of most other metals.

s on Mercury. By Messrs. IRA-OLIVA, of Portugal*.

or their objects: 1. To ascertain
cid, of phosphites, and of phos-
alts of mercury: 2. The analy-
by means of phosphorous acid:
of hyperoxygenated muriatic
y.

horous Acid upon the Oxides of ercury.

es of red oxide in contact with
oncentrated, the colour of the
ray. On boiling this mixture,
unning globules appear, which
hosphorous acid had passed into
, by combining with the oxy-
ry; and also that perhaps the
ned, had dissolved some portion
To ascertain this point, we fil-
r by sulphurized hydrogen: to
reagent afforded but extremely
sence of mercury. The resi-
e filter, after having been well
s nine grammes of mercury.
e red oxide of mercury contains
eight of oxygen.

nent points out new means for
rcury, which appear to us pre-
h is less expeditious, and is at-
convenience of not giving ac-
ercury reduced to the metallic
ident it may be volatilized, or
sels employed in the operation
tached.

, by means of this acid, to ana-
adding to them potash to de-
time that the phosphoric acid
running mercury; but the re-
Having tried this process on
of mercury, we obtained only
tead of 73, which we ought to

---

de Chimie, vol. liv.

have obtained, as we shall show hereafter. This loss of 0·7 is to be attributed in part to what was dissolved by the phosphoric acid which was formed, but still more, in our opinion, to the potash. Mercurial salts decomposed by means of this alkali always retain some of it. M. Berthollet has shown, that during the decomposition of these salts by potash, neither the redundance of the latter, nor ebullition, can entirely clear the solution of mercury.

2. *Of the Gray Oxide of Mercury.*

With phosphoric acid we treated ten grammes of gray oxide, obtained by decomposing by ammonia a solution of a sulphate of mercury at the minimum, strongly boiling the precipitate to dissolve and separate all the triple salt that might have united with it. From these 10 grammes we obtained 9·25 of reduced mercury, and we concluded that this oxide contains 7¼ per cent. of oxygen. The mean which we employed for obtaining the gray oxide of mercury seems to us preferable to that of precipitation by caustic fixed alkalies, which combine in part with the oxide precipitated, from which it is impossible entirely to separate them. When, in the method with ammonia, some portion of this adheres still to the oxide, we may easily expel it by a moderate heat.

3. *Of the Action of the Phosphorous Acid upon the Salts of Mercury.*

Having, without success, attempted to analyse the mercurial salts by means of caustic potash, we determined to treat them in a direct manner with phosphorous acid, and we obtained the following results:

1. Phosphorous acid in excess decomposes all the mercurial salts, without exception, reducing their oxides into running mercury, and entirely separating their radicals.

2. When these salts are at the maximum of oxygenation, it causes them to pass into the minimum before it decomposes them.

3. Mercury is completely reduced to the metallic state by this means; for, the oxide of mercury being united to a radical, which does not quit it entirely until it arrives at the metallic state, the phosphoric acid formed in the operation cannot dissolve the mercurial oxide, not being in contact with the mercury until it arrives at the metallic state. The acids, before united to the oxides of mercury, cannot redissolve it while the phosphorous acid which destroys the action is present. Should a phosphate accidentally

uld immediately be decomposed

the different Mercurial Salts.

preceding experiments, that the
the best means of analysing the
ted the following analyses.

bith Mineral.

mmes of this salt, very dry and
the mercury reduced, we filtered
per. All the reduced mercury,
le, weighed 7·7, which, accord-
ed oxide of mercury, is equiva-
ide. The filteted liquor, treated
gave 5 grammes of sulphate of
ent. of sulphuric acid, represent-
ere remains a loss of 3 centi-
ttributed to the moisture.—This
hat given by M. Fourcroy.

pitulation.

he maximum	-	84·7
- -	-	15·
sture, -	-	3
		100

f Mercury at the Maximum.

well dried, treated in the same
id, gave the following result;

-	-	63·8
-	-	31·8
ure	-	4·4

te of Mercury of Commerce.

with phosphorous acid, gave of
h represents 8·03 of oxide at the
liquor, treated with nitrate of
of silver, which represent 1·86 of
being formed by sublimation,
attributed the 11 centigrammes
lways found more or less mixed
ith in commerce.

Result.

Muriatic acid - - -	18·6
Oxide of mercury at the maximum	83·3
Loss attributed to the iron -	1·1
	100

On Nitrous Turbith, Nitrate of Mercury at the Maximum of Oxygen, and at the Minimum of Acid.

Ten grammes of this salt, as dry as possible, treated with the phosphorous acid, gave 8 grammes of reduced mercury, which represent 8·8 of red oxide of mercury: what is wanting to the complement of 10 grammes is to be attributed to the nitric acid, which we cannot collect in this operation, because phosphoric acid, by seizing a part of its oxygen, causes it to evaporate in nitrous vapours. The perfect dryness of the salt leads us to believe that the remainder of the weight may, without fear of error, be attributed to the nitric acid.

Result.

Oxide of mercury at the maximum	88
Nitric acid - - - -	12
	100

Of Phosphate of Mercury at the Maximum.

Ten grammes of this salt, also as dry as possible, treated in the same manner with phosphorous acid, gave 6·5 of running mercury, which correspond to 7·15 of oxide of mercury at the maximum; the 2·85 wanting to complete the 10 grammes, we attribute to the phosphoric acid.

This experiment proves that phosphorous acid not only decomposes all the salts formed by mercury with other acids, but also those which are formed by the phosphoric acid; so great is the affinity of this acid for oxygen, that it surmounts that of the mercury for the same principle, and at the same time the attraction of the phosphoric acid for the oxide of mercury.

This phænomenon also clearly points out the reason why the phosphoric acid, formed at the cost of the oxygen of the mercurial oxides, does not dissolve the mercury as long as any phosphoric acid is present; this decomposes in its turn the phosphate which might be formed.

Phosphites.

deoxygenate the oxides of mer-
comparably less than that of the
ears to be subordinate to the force
orous acid with its base, and to
equally exercise upon the oxides
es therefore do not seem to us to
affording an accurate means for
des. They also deoxygenate the
action is weakened by the same

us upon the Mercurial Oxides and Salts.

pted to combine phosphorus with
on treating the red oxide of mer-
y means of water, in a gentle
uret of mercury in which the
in a state of feeble combina-
d by the same operation some
ting his experiment we obtained
pears to us that the formation of
is produced in it may be differ-
of opinion that the phosphorus
acid) attracts a portion of oxy-
ir, and passes into the state of
has led us to form this conclu-
us which is carried off by the va-
at the surface of the latter; and
hosphorous acid, which must be
in proportion as it seizes the
of mercury. This explanation
tural, as phosphorus, placed in
does not become acidified, though
as we shall show hereafter, and
ter is changed, by this simple
s acid.

aced in contact with red oxide
st attracts oxygen from the red
of all into gray oxide, and at
; but in this case no phospho-
cid is formed; the phosphorus
nd assumes a dark colour. It
he theory of this phænomenon:
at avidity for oxygen, separates
ich it is in contact; but this

combustion is so slow, as is proved by the uniformity of the temperature of the liquor during the operation, that the phosphorus is never in a condition to seize upon the portion of oxygen required for its conversion into the acid state. The reduced mercury cannot combine with the phosphorus; for, as it does not combine with it when in the state of fusion (according to the experiments of Pelletier), it is still less capable of combining with it when in a solid state, and without any change of temperature. Our experiment may perhaps furnish the means of obtaining the true oxide of phosphorus, which hitherto has been little or not at all known.

The mercurial salts are equally decomposed and deprived of their oxygen by phosphorus, with the application of heat, or as in the cold; but, in the first case, a phosphuret of mercury is formed, which consequently prevents its analysis by this means. It might perhaps be accomplished in the cold; but the action is so slow, that any other more expeditious means would be preferable.

Of the Action of Oxygenated Muriatic Acid upon the Red Oxide.

This subject has already been investigated by Messrs. Fourcroy and Thenard, and it may easily be supposed that such able chemists have left little to be done in a field which they have already cultivated. We have obtained nearly the same results which they have indicated, and we return to this subject merely in order to notice some slight peculiarities which have escaped them.

Experiment I.

Fifty grammes of red oxide of mercury were put into a proportionate quantity of distilled water. Oxi-muriatic acid gas was then passed through it, taking care to agitate the liquor well, in order that the gas might come perfectly into contact with the red oxide. After the space of an hour the colour of the oxide began to change, becoming darker every moment; we continued to cause gas to enter till the brown powder had deposited itself; we then decanted the liquor, and washed and filtrated this powder, which had become of a deep violet colour: after being dried it weighed 29 grammes. The evaporated liquor presented to us a salt crystallized in the form of needles, which we ascertained by re-agents to be hyperoxygenated muriate of mercury; the last liquor, after the crystallization, presented to us slight traces of another salt more highly oxygenated than the preceding;

was too small to be subjected to

h has hitherto been considered
more or less oxygenated, being
eriments, gave the following re-

as found insoluble in it, and did
colour.

potash, it was converted into red
tained muriatic acid. There ex-
der a muriate of mercury.

the nature of the latter, and to
which it was contained in it, we
this powder, and obtained 2
uriate, and 8 of red oxide not
muriate dissolved almost entirely
he extremely small portion which
nuriate.

he violet-coloured powder which
the oxi-muriatic acid upon the
not a simple oxide of mercury,
cury, with a great excess of red
proportion of 2 to 8; that this
combined with the salt; at least
the first experiment, since boil-
separate the muriate of mercury

eriment II.

ces of which we have just given
l the possibility of forming a hy-
mercury, of a degree superior to
e. As the action of the oxygen-
given in the cold so satisfactory
boiled 30 grammes of red oxide
ed muriatic acid, taking care to
portion as it was absorbed by the
efused to absorb any more, the
he powder washed and dried; the
nearly the same as in the former
e same re-agents it gave us simi-
ation it yielded the same propor-

erly evaporated, it yielded oxy-
ury perfectly crystallized. The
r not presenting any appearance
of

of crystallization, were evaporated to dryness, and presented to us what we sought for, a hyperoxygenated muriate of mercury, possessing the following properties:

1. It is highly soluble and deliquescent.

2. Much more soluble in alcohol than the ordinary oxygenated muriate.

3. It decrepitates with concentrated sulphuric acid, assumes a yellow colour, and disengages oxygenated muriatic acid gas.

4. The essential property, which no other salt besides this is known to possess, is, that being mixed with the sulphuret of antimony, it inflames spontaneously at the ordinary temperature, some instants after the mixture is made. The residuum of this combustion, besides the sulphuric or sulphurous acids which are disengaged, consists of oxygenated muriate of mercury (corrosive sublimate) and muriate of antimony. It appears, therefore, that, in this case, the superabundant oxygen of the hyperoxygenated muriate burns a portion of the sulphur, and produces sulphuric acid, and a portion also of the antimony, which then combines with some of the muriatic acid from the mercury. This salt, however, possibly on account of its extreme deliquescence, does not decrepitate upon ignited coals, nor does it make any explosion when struck by a hammer.

The oxide of mercury combined in this salt is of the same nature with that which is combined with oxygenated muriate. The alkalies likewise precipitate it in a yellow oxide.

Conclusion from the last Experiments.

Oxygenated muriatic acid produces, therefore, with red oxide of mercury, principally by the aid of heat, different kinds of salts.

1. Muriate of mercury at the maximum, with a great excess of oxide, resembling turbith mineral as to its insolubility in water, but reducible by sublimation into oxygenated muriate of mercury, and into red oxide.

2. Simple muriate of mercury. This salt accompanies in small quantity the preceding salt.

3. Oxygenated muriate of mercury, which crystallizes by the evaporation of the liquor.

4. Hyperoxygenated muriate of mercury. This salt is extremely soluble, and not crystallizable.

Such are the remarks which we had to offer respecting the action of phosphorous acid, and oxygenated muriatic acid, upon the mercurial salts and oxides. Justice requires that

edge the advantage which we have
from the practical skill and che-
mier, who has assisted us in our
ur solicitude to give them all the

Conjecture.

beg leave to offer a conjecture to
ven rise. We feel the less reluc-
it refers to a point which, in the
ledge, cannot yet be a subject of
nse of the term.
mercury, in the state of oxide or
edicine for the cure of venereal
this remedy are well known, but
r from being so. Does it act by
with the principle of the disease,
gen, and being reduced itself to
latter opinion, which has some
the most probable. The experi-
just given an account, persuade
nces which the mercurial oxides
in the animal œconomy, none can
gen so easily as the phosphorous

ll us, that there may exist in the
or alkaline earths, capable of de-
salts, and separating their oxides.
at the alkalies do not exist in the
ids, and that consequently their
affinities combine with the oxides
ven though the oxide of mercury
substance would still be required
oxygen. It is possible that such
ered in the human body; but we
n possesses the property of seizing
les of mercury in a degree at all
rous acid and the phosphites. It
ntity of phosphoric acid is con-
y: of this the phosphate of lime
s is a proof. It is easy to conceive
rous acid and phosphites in the
horous acid in reality is nothing
with an excess of phosphorus.
that the formation of phospho-
es might perhaps be supported by
the

the following observations: 1. That the malady in question has its origin in the contact of the fecundating parts: 2. That phosphorus performs a principal part in the functions of reproduction. Pelletier has remarked, that phosphorus is the most powerful aphrodisiac known; analysis has shown that the crystals of the human semen are phosphate of lime. Phosphorous acid and phosphites would therefore vitiate the spermatic liquids, which would not be restored to their natural state until the phosphorous acid and the phosphites, seizing oxygen from the mercurial oxides, should return to the state of phosphoric acid and of phosphates, such as they are found in the state of health.

Note of M. VAUQUELIN.

There is no necessity that we should have recourse to the presence of phosphorous acid or of phosphites in the animal liquids, which is by no means proved, in order to explain the reduction of the salts and oxides of mercury, since almost all the animal humours produce this effect.

XI. *New Method of preparing Alum from Pyrites and Clay. By M.* LAMPADIUS, *Professor of Chemistry and Metallurgy at the School of Freyberg*[*].

I HAD long been of opinion that the sulphuric acid vapours disengaged from pyrites while burning might be applied to some profitable use. In this process, as is well known, when the combustion is once begun, by applying burning wood or other fuel to the pyrites, they can maintain it by their own sulphur; and a certain quantity of sulphuric acid is formed, which is generally allowed to dissipate itself without producing any benefit.

In a journey which I took in 1799 to the vitriol manufactory of Breitenbrunn, in the district of Johann-Georgenstadt, I had the satisfaction to observe that these vapours were turned to some account. The pyrites were burned in a furnace of a conical form, open at the top, and in the sides of which were apertures, with pipes conducting to a large square chest, filled with pyrites that had been burned and lixiviated, and had thus furnished vitriol. When the pyrites in the furnace are kindled, the aperture at the top is closed. The pyrites still continue to burn; the vapours

---

[*] From the *Journal des Mines.*

d collect in the chest called the
d themselves with the lixiviated
ontain a quantity of highly ox-
es with the sulphuric acid, and
e pyrites have remained a suffi-
y are again lixiviated, and more
hem*. Perfect sulphuric acid
of the same service as vapours,
rated with oxygen.
deas relative to the employment
isengaged during the burning of
ceed to state the experiment I
alum, I shall introduce an ob-
rocess employed by M. Chaptal.
phur with the saltpetre, as is the
ufactories of sulphuric acid; he
uric acid, which are disengaged,
forms an artificial ore of alum.
sive to oxidate immediately the
e atmospheric air? By the latter
ations would be spared—that of
that of burning it with saltpetre;
nsiderable price. I admit that,
oing to describe, all the vapours
e; but if the apparatus be pro-
ill be lost.
ark concerning the state of the
ployed. Pyrites merely broken
are triturated and washed, when
n the other: if pyrites in powder
y should be mixed with a fourth
nd dried in the form of bricks.
he pyrites is not detrimental to
because the arsenic, being less
the sulphuric acid, is arrested
the pipes, where care must be
. As to the clay, that used by
rovided it does not contain too

y furnace, four feet long, two
nd three quarters high, to be
rt had an aperture a foot square,
ntroduced. On the sides of the

---

is not perfectly correct. Water is made
into the chest: this water passes through
nstantly lixiviated.

arch were apertures two inches in diameter, which could be opened and shut at pleasure. At the top of the vault was another, of an oblong form, conducting to a wooden channel a foot and a half wide, but which, on account of want of room, was only twelve feet long, and terminated in a chest three feet in diameter. Such was the imperfect apparatus with which I made my first experiment.

A quintal of pyrites, triturated and washed, were mixed with half their weight of clay, and formed into balls, which were gently dried. Another quintal of clay was likewise formed into balls, which were dried and baked, but only till the clay had lost its unctuosity, and was therefore more proper to receive the vapours of the sulphuric acid. The balls of the pyrites were placed in the furnace, on about a cubic foot of wood, intended for kindling the fire. The aperture in front was closed, and only those on the sides were left open: the balls of clay were exposed in the canal and in the chest to the vapours of the sulphuric acid. The combustion of the pyrites continued fourteen hours, and not a vestige of sulphur was deposited; that substance became entirely volatilized under the form of sulphuric acid*. The wooden channel was too short, as I had expected; the greater part of the vapours escaped; the trees and plants in the garden contiguous to the laboratory withered, and their leaves fell off. I, was therefore convinced that the pyrites were completely oxidated in my apparatus. As soon as the operation was ended, the balls of clay were covered with an effervescence of alum, which, mixed with 4 per cent. of alkali, yielded alum.

But as the greatest part of the acid was mixed with the alumine, without being saturated with it, I left the balls in a shed, exposed to the action of the air, from August 2, 1799, till the 3d of April the following year. At the expiration of that time I obtained an earthy mass, entirely covered with an efflorescence, and mixed with sulphate of alumine; being treated in the usual manner, it yielded three pounds and a half of alum.

This experiment convinced me of the possibility of obtaining alum by this process, and that in a very œconomical manner: but, to insure success, the tube should be made much longer than mine. The remaining pyrites may afterwards be employed in the manufacture of vitriol.

---

* We cannot help here suspecting the accuracy of M. Lampadius. It seems likely that by far the greater part of the vapours would be in the state of *sulphurous* acid. Edit.

nication from Dr. THORNTON,
umatic Medicine.

. Tilloch.

Hinde-street, Manchester-square,
October 21, 1805.

rdinary publication against the
illustrious Dr. Jenner, he puts
ses of mankind, their belief of
m pneumatic agency. "Cow-
' is an easy mode of aspersing,
e community, those who wish
o be, benefactors of mankind:
ion of my name to the *philo-*
tribunal I am feelingly alive;
ny do, after pecuniary gains,
nded to deprive me of. If I
mad, I trust it is the madness of
on of the truth: I shall there-
ases confirming the practice.

, Sadler, to Dr. THORNTON.

l by Carbonic Acid Air.

Oxford-street,
October 20, 1805.

most striking good effects, I
the *pneumatic* practice, I am
as publicly known as possible.
miserably afflicted with herpes
to the sole of my foot, and had
mith, and other gentlemen of
affliction baffled all their skill.
arley, and he recommended the
confined by means of oil-skin,
hour each day; and such were
cts of the air, that in the course
sal disease was removed. It
go, and I have never felt any
st comfortable state of health.
he honour to be, sir,
ır faithful obedient servant,
MATTHEW WILSON.

Observations

Observations on this Case by Dr. Thornton.

1. The herpes is a species of hitherto incurable leprosy, and was confirmed in the habit of this gentleman, having existed, as he writes to me, twenty-five years.

2. The common means failing, the trial of carbonic acid air to the parts affected was a judicious application.

3. If meat is put into fixed air it does not become putrid, and even tainted meat becomes sweet by immersion in fixed air.

4. Fixed air also takes off inflammation; for if a blister be cut, and fixed air be applied, the pain instantly ceases.

5. In this case it evidently promoted action, for after each application a moisture always prevailed; the incrustations were before hard and dry.

6. As the cure has existed seven years, a relapse is not to be dreaded; and this case is, I think, a very striking example of the propriety, not of the "madness," of the application of the pneumatic agents.

I have the honour to remain, dear sir,
Your obliged devoted friend,
ROBERT JOHN THORNTON.

XIII. *A specific Remedy for the Tinea Capitis.* By *Mr.* JAMES BARLOW.

To Mr. Tilloch.

SIR,

HEREWITH you will receive an account of a specific remedy for the *tinea capitis*; the insertion of which in your valuable Magazine will much oblige

Your obedient servant,
JAMES BARLOW.

Blackburn, Lancashire,
October 20, 1805.

Most practitioners in medicine must have frequently experienced the difficulty of curing this obstinate malady. The intractableness of most children when attempted to be controlled or governed by the accustomed mode of treatment, renders the disease in most instances very difficult to subdue; and the quickness with which the hair of the scalp grows in children, has hitherto almost always rendered every effort to conquer the disease of no avail.

It was from a constant failure under the numerous and diversified remedies which have been recommended by authors in this malignant disease, that I was led to adopt the subjoined

n happy to announce to the pub-
ected head therewith a few times,
l suffering the parts to dry with-
bs will decorticate and peel off
the parts underneath perfectly
torturing the patient by either
ng off the hair. I have been in
disease in this manner, and with
last ten years, and have invaria-
when duly applied) both in chil-
nany inveterate cases even where
en previously used without effect,
eral years standing.

cens preparat.) ℥ iij.
℥ jss.

ij.
apitis.

emedy for *tinea capitis* be effica-
adful endemic disease called *tri-*

---

on of Alkaline Sulphurets by the *Manganese.* *By* M. Dize[*].

an alkaline sulphate, and then
rature, the oxygen, one of the
d, burns the charcoal, quitting
as its radical; with which the
ning what is called an alkaline
tion, which is a result of the de-
sulphates by the charcoal, is not
ht be supposed, especially when
pon. The exposure, frequently
sulphurets to a managed heat, is
e sulphur to volatilize; for the
f it to render it improper for cer-
and the sulphur during its vo-
ated, and forms sulphurous acid,
alkali. Thus the operation is
nstead of being simplified, since
ixed with sulphuret and alkaline

---

ons's Journal, No. 15.

The addition of carbonate of lime to a mixture of charcoal and alkaline sulphate, as was the practice in the first manufactory of soda, established at St. Denys, near Paris, was not an expensive way of decomposing pretty speedily the sulphuret of soda resulting from the decomposition of the sulphate of soda by charcoal; nevertheless the soda was still contaminated with sulphuret and with sulphite of soda, which might be detected by the smell and by the crystallization. The substitution of iron for carbonate of lime, or these two substances employed together, gave no better result. The whole of the alkali could not be obtained pure till after repeated washings, calcinations, and crystallizations.

Such is the state of our knowledge of the means of purifying in the large way, and without incurring too great an expense, the alkalies which may be prepared by the decomposition of the alkaline sulphates. These difficulties, which appear of little consequence in the operations of the laboratory, become very embarrassing in large manufactories, where the results ought to be equally speedy and easy to be obtained.

Of all these processes the best is that employed in the manufactory of St. Denys, near Paris, and which was published at the time by order of government. This process is still the most simple, and most easy to be executed in the large way; at least it has been judged so according to experience. I believe that the result of my researches upon the decomposition of the sulphurets must add to its perfection, and afford some indication of which use may be made in analogous operations.

I shall not detail all the experiments which have led me to this improvement, but shall now state the means which I employ for decomposing the alkaline sulphurets, or freeing the soda from the last portions of sulphuret and alkaline sulphite which it contains.

After having proceeded to the decomposition of the sulphate of soda, by the mixture of charcoal and carbonate of lime, we lixiviate the crude soda, in order to extract the alkali from it. This lixivium is commonly of a yellowish colour, and exhales the odour of sulphur: if we mix with it some drops of diluted sulphuric acid, sulphur is precipitated, and hydro-sulphurated gas and sulphurous acid are rapidly disengaged.

Were we to evaporate afterwards and crystallize this lixivium, we should obtain crystals of soda, from which diluted sulphuric acid would disengage hydrosulphuret and sulphurous

of the liquor would give soda
tallization.

and free the alkali from the sul-
solution, and cause the sulphite
ley, while it is in ebullition, a
pulverized semi-vitreous oxide of
the sulphur from the alkali, and
an insoluble sulphuret of lead:
is converted into sulphate. The
loses its red colour, and assumes
hue, by reason of the quantity
li contains. The liquor or lixi-
ure water; dilute sulphuric acid
onic acid gas, and forms no pre-
xivium precipitates the nitrate of
he sulphate of copper is a beau-
s to the addition of the semi-
same lixivium precipitated these
chestnut colour, that is to say,
Thus the semi-vitreous oxide of
arries off the sulphur from the
y serve for purifying in the large
anner, the soda proceeding from
lphate of soda.

and a calculation of the expense
of lead, I substituted for it, with
nganese well pulverized. This
an the former, presents another
oyed several times for the same
om the sulphur by simple cal-

sulphur is thus separated from
hout engaging it in a new com-
aving it isolated and dissolved
to try the same means for de-
ytes; and my attempt was at-

Sulphuret of Barytes.

s in a caustic state, sulphate of
posed with charcoal, from which
huret of barytes soluble in water:
ed with nitric acid: distillation
m the barytes, and this alkali
the bottom of the retort. This
sive, on account of the large
quantity

quantity of nitric acid which it requires. Barytes will certainly become a very valuable substance for the arts, when we shall be able to procure it at a reasonable price.

The following is the most simple and the most œconomical means which I have discovered, and which I had a long time practised for my own use.

When sulphuret of barytes is made by the decomposition of sulphate of barytes and charcoal, I dissolve it in water; after having let it settle and clear itself, I decant it into a vessel, in which I boil it, adding to it pulverized oxide of manganese, till the liquor has lost its yellow colour, and is become clear and limpid.

In proportion as the oxide of manganese separates the sulphur from the barytes, the odour of sulphur diminishes, and instead of it an alkaline odour is perceived; the taste of the liquor, when all the sulphur is combined with the manganese, has a considerable degree of causticity; as soon as it cools, if too much water has not been employed for the solution of the sulphuret, the barytes crystallizes round the vessel.

Nitrate of lead and sulphate of copper are precipitated from their solvents by caustic barytes, the first in a white, and the second in a blue form: thus oxide of manganese has a stronger affinity with sulphur than either soda or caustic barytes has, since this oxide, at the mere degree of ebullition, decomposes these alkaline sulphurets completely. This process appeared to me simple enough to be applied to the preparation of these two alkalies upon a large scale, so as to afford them at a reasonable expense to the arts in which they may be used.

Since I first perceived that oxide of manganese attracted, in the humid way, sulphur from fixed alkalies and from barytes, this means has been a great assistance to me in getting rid of the alkaline sulphurets in many analytical operations, in which the presence of the alkaline sulphuret embarrassed me, without my requiring an acid to decompose it.

Soda and barytes prepared by this process are very pure, and are obtained at a very moderate expense, especially barytes.

paring pure Gallic Acid. By
Richter*.

ne pound and a half of gall nuts,
powder, taking care frequently to
s the liquid through a cloth ; add
efuses to go through, and again
using a press to separate the wa-
id with a gentle heat evaporate
ark brown colour, and very brittle,

n this matter, reduced to a fine
traw colour. The deposit infused
icates but little colour to it. The
is composed almost wholly of

extracts, which distil in a small
hat remains will be almost a solid
nd expose it to a gentle heat, and
l almost colourless solution.
, and you will obtain from it very
crystals. The liquor furnishes
only a little coloured. It is suf-
with water to obtain them very
lf an ounce of crystals is procured
these crystals are extremely light,
a considerable space. They pos-
es :
in water than in alcohol. Dis-
den tincture of turnsole. They
arbonates, separating from them

es form black precipitates in so-
ise decompose all other metallic
ion of pure gallic acid be added to
ar solution of iron, no change of
solution of iron is decomposed by
oxidating the iron still more, and
of a different nature, more fa-
ion of the gallic acid with the
roduces a black colour. If to a
xide of iron recently precipitated,
black precipitate. The same re-

---

nnales de Chimie, vol. lii.

sult is obtained by bringing oxide of iron in contact with a solution of pure gallic acid.

Iron treated with a solution of gallic acid soon communicates to it a black colour, which, however, can hardly be precipitated from it.

Tannin is soluble in gallic acid, and yields with it a liquor resembling the infusion of galls, and which has the property of instantly precipitating acid solutions of iron black, by a double affinity; the tannin combining with the acid, and disengaging oxide of iron, which unites with the gallic acid.

It results from these experiments:

1. That gallic acid does not separate iron from sulphuric and some other acids, excepting some change of combination takes place in the solutions: in this case the iron, becoming more oxidated, requires a much greater quantity of acid, and the redundant oxide of iron unites with the gallic acid.

2. That when a solution of gallic acid immediately forms a black precipitate in neutral solutions of iron, it is not pure, and commonly contains tannin, which combines with the sulphuric acid, and separates from it the oxide of iron which is dissolved by the gallic acid.

3. That during the preparation of gallic acid, all contact with iron must be avoided, even in the filtering paper, which is rarely free from it, otherwise the acid is discoloured by the iron. It may easily be discovered that the acid contains iron, when, in evaporation, small violet spots are formed in the places where the acid is about to crystallize.

4. That as gallic acid dissolves very readily in alcohol, and tannin scarcely at all, this reagent may be employed to separate them. The alcohol, however, should be very strong; for, if it contain ever so little water, some tannin will be dissolved.

5. Of all the processes recommended for the preparation of gallic acid, this furnishes it in the greatest abundance and of the best quality. For, if we consider in particular that recommended some years ago, which consisted in employing the solution of muriate of tin, afterwards sulphurized hydrogen gas, and lastly alcohol, we may readily conceive, particularly if we have practised it, how defective, expensive, and disadvantageous it must be; and at last it amounts to nothing more than rendering tannin insoluble in alcohol; and nothing is effected excepting that this reagent dissolves gallic acid alone. As to the process which recommends the use of glue, that is quite as bad: you in-

g the greatest part of the tannin;
, nevertheless, remains in solution;
liquor which is obtained after the
te formed by the glue is nothing
ie, tannin, and gallic acid, from
allic acid in pure crystals can be

◆

h of Mr. George Margets, the East India Company, and e and Horary Tables.

was the fourteenth and youngest
l Martha Ellis his wife. He was
1748, in the parish of Old Wood-
lis father was a wheelwright, to
eldest brothers were brought up.
arly distinguished by the vivacity
intended for a commercial em-
to school for the rudiments of a
he death of the old man inter-
ie elder brothers unwilling to be
ishing the purpose of their father,
low the profession of his family.
ther at the school of the reverend
genius was early distinguished
lars for an assiduity very unusual
cially for an eager interest in the
At the age of fourteen he was
; in which situation he became
studies, that he used to rise by
mer mornings to follow his own
our of going to his trade.
n he constructed a machine which
tions of the earth. Of the con-
f that performance, no means of
by his own estimation of it, after
as a time-piece maker, that it is
d preservation. When he had
make a clock; but not having
e pocket-money, he was obliged
to complete the clock, which is
ugh a rough piece compared with
ers with which he has benefited
navigation,

navigation, is exceedingly curious, as it exhibits the diurnal motion of the earth, the progress of the zodiac, the spring and neap tides, with the revolution of the seasons. There is an anecdote connected with the history of this clock that deserves to be recorded. A gentleman one day had occasion to speak with Margets, and not being pleased with his answer to a question, exclaimed peevishly, You are a fool. 'No, sir,' was the retort; 'that I am not a fool I can easily convince you.' The peculiarity of the reply surprised the gentleman, who immediately asked an explanation; and was conducted to the apartment where the clock hung, and several other little finished and incomplete pieces of mechanism lay scattered. On this incident hinged the success of his future life. The gentleman, surprised by the unexpected display of mechanical genius, spoke of it among his acquaintance, by whom a knowledge of Margets reached the duke of Marlborough, who afterwards, as shall be related, became his patron. About this time, to supply the want of money, that he might obtain materials for prosecuting his favourite pursuits, he painted, during his leisure hours, the names of the proprietors on the waggons and carts of the neighbourhood,—the act which imposed that regulation being then executing. It deserves to be noticed, that although so earnestly attached to the higher mechanical works, such was his general ability, that he excelled all the common wheelwrights at their sole employment, and could, in any given time, perform more work than the best of his brother's journeymen.

After finishing his apprenticeship he remained two years with his brother: his proficiency by this time in the knowledge of clocks and watches had become so well known, that all the intervals of his regular business were employed in repairing the clocks and watches in the vicinity of Woodstock. At the age of twenty-three he went to London, for the purpose of obtaining a regular knowledge of watchmaking; and the duke of Marlborough paid the fee that was demanded before he could be admitted into the shop of an artist. It can easily be conceived, and the sequel will show how justly, that a man so assiduous, and so devoted to that profession, which Margets was now allowed to cultivate, would soon excel all common competitors, and improve and extend the boundaries of his art.

In 1776 he married the eldest daughter of Mr. Bellamy, of Charles-street, Long Acre, by whom he had only one child, that died in infancy. Mrs. Margets is still living.

After

Ir. Margets continued to apply to
ith that perseverance and assiduity
attachments of eager and enter-
h with humbler talents is respected
His attention was chiefly directed
his machines, which from the pe-
their construction became articles
and were sought after for that pur-
easing demand, that his pecuniary
consequence gradually benefited.
1781, however, when the political
so much distracted as to affect all
trade, his stock of goods began to
and his customers to diminish; by
compelled to solicit the assistance
y readily granted him a considera-
his own bond. But unfortunately
ered, in the end, of very vexatious
well as to him, by the chicanery of
, who persuaded them to put the
ff the stock of Mr. Margets' shop,
kept to himself.

s at this time retired to private
evered in his business with unre-
occupying the intervals with the
gitude and horary tables that have
his thoughts to have been superior
nuity. His longitude tables were
r 1790, and were immediately re-
ged by the most distinguished na-
ans. M. de Lalande mentions them
tering terms of approbation; and
public companies of this country
their use both by subscription and
after, he completed his horary ta-
thers, form the best assistance to
ongitude by astronomical observa-
red to the public. Besides these
ny little mathematical machines,
her subjects of amusement than
rving of particular enumeration.
thorship till the summer of 1804,
object in view, and continued to
his business and publication with
eputation: indeed, the intenseness
of

of his assiduity had so affected his sight, that he was at one time threatened with total blindness, and obliged to sustain an operation on his eyes in 1801.

The circumstances that remain to be noticed are of a most distressing and melancholy nature. Mr. Margets had been all his life, like every other man whose thoughts are employed on abstract objects, or in the adjustment of equilibria in machinery, remarkable for an impatience of interruption in his pursuits, attended with a violence of choler that often rendered him irksome to himself as well as to his acquaintance. On the 27th of June 1804 he was seized by the most deplorable malady that can fall upon the human race. The whole of that day he had been unusually passionate and dissatisfied: in the evening, while he was sitting with Mrs. Margets, and two young ladies who then resided with her, he became calmer, and began to express a kind of contrition for his extravagance: suddenly an apprehension of insanity flashed upon his mind, and he exclaimed, "Good God, is this to end in madness!" and, bursting into tears, continued to weep with his family, whose affliction may be easier imagined than described. His disorder continued to increase, and the lucid intervals to diminish: he was, however, for several days not altogether incapable of business. In this state he forced the family to go with him to Portsmouth, where they continued about two weeks, in the unhappy situation of seeing the ravages of the disease upon his person. At length he was persuaded to return home to London, where proper attendance and advice were immediately procured; but his case was of such a class that Dr. Willis entertained no hope of his recovery. In the course of a month, so entirely had the disease enveloped his intellects, that he had lost the occasional sense of his own distressful condition; and it was thought advisable to send him to St. Luke's, where he would be prevented from committing any violent actions. After he had continued in that hospital about four months he began to refuse his food and medicine, and grew so ill and meagre that it was not expected he could live long. He was therefore taken home. As he approached the period of life his strength decreased; but his mind assumed a more coherent character, and his reason seemed to return. About three days before he died his faculties were restored; his strength, however, was reduced so low that he could not speak without pain. He died on the 27th of December 1804.

J. B. G.

of Sulphate of Potash. By M. OERSTED*.

erlin, I had begun in the laboratory
ries of experiments on the inert or
of Winterl. The sulphurous acid
l my operations was made after the
Fourcroy and Vauquelin; but in
tral sulphate I obtained an acidu-
the solution turned blue vegetable
made an effervescence with acids.
n was scarcely crystallizable.
h could no longer change itself into
nd Vauquelin suppose; but a triple
sed of sulphuric acid, sulphurous
salt crystallizes itself in hexangular
in water than the sulphate of pot-
he sulphate of the same alkali; and
more powerful, such as sulphuric
of sulphurous acid gas.

---

ings of Learned Societies.

L INSTITUTION.

nmence on Monday, the 11th of
ral courses will succeed each other

nistry.
ral philosophy.
on English literature.
ngraving.
, on moral philosophy.
al and physical history of man.
e, on poetry.
ing.
ogy.
on belles lettres.
sic.
r, on commerce.
ing.
ny.

Mons's Journal, vol. VI.

LITERARY

LITERARY AND PHILOSOPHICAL SOCIETY, NEWCASTLE UPON TYNE.

This society, in its twelfth year's report, has published a resolution which, if adopted by other institutions, might be productive of mutual advantage. The following is the resolution to which we allude:

"That the subscribers to the public library at North Shields (and to other similar institutions which shall afford an equal accommodation to the members of the Newcastle Society) shall be admitted to the rooms without introduction, on producing to the librarian a certificate of their being members of such institutions."

ORIGINAL VACCINE POCK INSTITUTION.

The following statement was entered by Dr. Pearson on Friday September 27th:

1. That the human animal œconomy and the animal œconomy of cows are capable of undergoing the vaccina once only.

2. That the human animal œconomy is, according to the most accurate evidence, capable of undergoing small pox once only.

3. That the animal œconomy of cows is unsusceptible of the small pox.

4. That the human animal is incapable of taking the small pox subsequently to the cow-pock.

The preceding propositions are only to serve as a foundation for reasoning conjointly with the following propositions.

5. Observations contained in our registered cases show, that the change effected in the human animal œconomy by undergoing the cow-pock or small pox, which renders it unsusceptible of either of these disorders a second time, is not wrought in a moment, as if from an impulse, but it is gradually produced during several days.

The duration of the agency of the vaccine or variolous matter in producing this unsusceptibility seems to be commonly three or four days.

It scarcely or perhaps never commences earlier than the 8th day after inoculation, nor later than the 12th, unless some counteracting agent or circumstance suspend or impede the action of either of the two morbid matters. Of course the duration of the agency of them is for about four days successively, from the 8th, 9th, 10th, 11th, and perhaps the 12th. For brevity and distinction, the time during which the state of unsusceptibility is effected may be called

s; and the state so produced may
us state.
stances which are registered, that
tter may be circumstanced so that
te agencies upon a given human
emporary; *i. e.* commence their
In such instances, a very much
es of severe constitutional disorder
y inoculated small pox; and al-
requently appear, they are most
of shorter duration, and defective
spects of size, in not suppurating,
g infectious matter. Oftentimes
mples, and sometimes no eruption

r has in many instances been
utional agency at various periods,
process is going on by variolous
ircumstances there was a much
emptions from eruptions; and al-
nstances of small pox regular and
of pimple, vesicle, and pustule,
proportion of slight and defective
proposition 6; and if in certain
not seem to be mitigated and ren-
no indication that they were in
severe. In general, the degree of
directly as the length of time be-
variolous matter and the subse-
ccine matter, within the limits of
successive insertions of the two
in conjunction during the *anti-*

r also has been made to exert its
arious periods of the antivariolat-
ccine inoculation, and then there
ruptive cases: the eruptions were
number, of shorter duration, and
t only having no purulent matter,
in the set of cases last mentioned
e the constitutional illness occur-
than in the preceding cases.
circumstances in which the two
ed to exert their energies were the

accine and variolous matter into
aded parts.

2d. The insertion of vaccine and variolous matter into the vaccine pimple or vesicle already formed.

3d. The insertion of vaccine matter into the variolous pimple or vesicle already formed.

4th. The inoculation of variolous and vaccine matter on distinct parts, but at the same time.

5th. The inoculation of variolous matter at certain determinate times, after vaccine inoculation, in distinct parts, but on the same person.

6th. The inoculation of vaccine matter at certain determinate times after variolous inoculation, in distinct parts, but in the same person.

7th. The inoculation of the two morbific matters contiguously, yet so that either as the vaccine and variolous grew to a certain size, the matters intermingled, or they were mingled by perforating the vesicles to render them confluent.

Remarks.

1. The inoculation with the matter of the vaccine and variolous vesicles existing in the same persons, excited simple regular vaccina and variola in distinct persons.

2. The inoculation with the matter of the vesicle produced by the insertion of both vaccine and variolous matter commonly produced the vaccina without eruptions: sometimes, however, they did occur, but the matter of these eruptions did not in two or three trials excite either vaccina or variola. From the irregularity of the pock of the inoculated part and the eruptions, it seemed reasonable to conclude that perhaps such matter consisted of both vaccine and variolous, which was capable of propagating the two diseases in some instances conjointly. The experiments on this point, however, are considered to be inadequate to answer the question.

3. The trials of the late Dr. Woodville and the reporter, by inoculating with mixed variolous and vaccine matter, proved formerly that no hybrid disease could be formed: but their former conclusion does not now seem just, that in some instances the variolous disease, and in others the vaccine alone, was excited by such matter; nor had they then the least notion of cotemporary agency of the two morbific matters both locally and constitutionally.

4. There will now be no difficulty to explain the instances of breaking out of the natural small pox eruptions between the 8th and 14th day in the vaccine inoculation, without seemingly disturbing the progress of the vaccine

pock,

f pimple, vesicle, scabbing, and

he preceding sources of observa-
s, and uniform, in establishing

R POSSESSES THE PROPERTY OF
OF VARIOLOUS MATTER; BUT
NOT THIS POWER AGAINST THE
ting power is not mutual, it is on

ication to practice, it seems, from
w just enunciated, to be a con-
constitution in which the appro-
atter has been exerted, is render-
he appropriate variolous agency

rrences of the small pox during
riola, in persons who have been
cinated, prove that the process of
duly excited. These failures af-
principle, but a great one to the
s fortunate for the public, though
s, that the current year has mani-
any persons who have been ino-
, as it may be the means of se-

which are the result of a great
l with patient diligence, confirm
y strongly established by an infi-
of inoculation in common prac-
t the human animal œconomy
f the variolous disorder, by hav-
-pock.
ersons have certainly taken the
accination; and this it was pre-
ng ago, in the "Report of this
ther work, "The Statement of
asserted, that in a future epide-
asonably be expected that many
er. But the late failures and in-
already inoculated for the cow-
ainst the efficacy of vaccination;

r the new practice the history of
sufficiently investigated to afford

2. That many inoculators do not appear to have been masters of what was investigated by others, or they had not had sufficient experience to attain requisite skill.

3. That a great proportion of asserted failures were mistaken, either in the patient's not having the cow-pock in the first instance, or the small pox in the second. The reporter's confidence will not be at all shaken, until in his own practice he is a witness to very different cases from those he has hitherto seen; or until professional men, with equal opportunities and equal attention, have stated their adverse evidence to the public. He is persuaded that the subject of the vaccine disorder is now sufficiently investigated for secure practice, and feels himself justifiable in affirming, that in future the occurrence of the small pox after vaccine inoculation WILL BE IMPUTABLE TO THE INOCULATOR BEING UNQUALIFIED, PROVIDED THE PATIENT BE OBEDIENT TO HIS DIRECTIONS.

It is necessary to notice, that the property of vaccine matter in counteracting the agency of variolous matter cannot be determined but by a number of trials in different subjects, because either of the two morbific matters may act merely locally, and in some cases may fail even to produce local effects. The reporter, as on former occasions, is willing, at convenient opportunities, to repeat any of the trials to prove the above results from evidence at the Institution.

Note.—It is a reasonable inference, that if a person has already received the small pox matter into the constitution at the time of vaccine inoculation, there will be not only a chance of the agency of the vaccine matter, so as to anticipate that of the variolous altogether, but also of a coincident agency, by which the small pox will be mitigated. Hence, persons who had been exposed to variolous effluvia ought, of all others, to be inoculated with vaccine matter.

P. S. Having no doubt excited the most interesting curiosity, and perhaps great doubts of the validity of the conclusions in the above minutes,—if required by our readers, we shall ask permission to illustrate them by examples in practice, which are registered at the Institution for insertion in future numbers.

IMPERIAL ACADEMY OF SCIENCES, PETERSBURGH.

The minister of the Russian marine, vice-admiral Tchitchagoff, has sent to the academy a question on the resistance

s application to naval architecture,
ublished in the following terms:
he resistance of fluids proposed and
ure by Don G. Juan, in his *Exa-*
I. Romme, in his *Art de la Ma-*
one or the other of them, for ex-
shall be corrected and improved to
d results that shall differ from the
y so small a quantity as may be
hout sensible error:—Or, if these
ected, that a new theory shall be
naval architecture, which shall
e same degree of accuracy;—Or,
ossible to establish such a theory,
experiments at least there should
embling those which have been
and Prony; and such that it shall
nable to experiments than those
l lead as nearly as possible to the
experiments, even when the for-
naval architecture.
ution of this problem the depart-
ppointed a prize of 1000 Dutch
eived till the 1st of July 1806, after
s addressed to the academy will be
the time appointed being sufficient
s which the solutions in question
he memoirs forwarded to the aca-
a distinct legible character, either
or Russian language.
men of science who intend to
prize, to address their memoirs to
that body, before the 1st of July,
should clear the post charges as
their respective countries will al-
ode of marking the memoirs with
ending at the same time a sealed
device, and containing the name
hor, is also to be adopted in the
memoirs will be examined by the
and by the academy; the latter
judgment they shall adopt, and
rine will bestow the prize on that
atisfied the conditions of the pro-

XIX. In-

XIX. *Intelligence and Miscellaneous Articles.*

RESTORATION OF THE GREGORIAN CALENDAR IN FRANCE.

By a decree of the French conservative senate, the new calendar is to be abolished, and the old one substituted in its stead. The following is an extract respecting this change from the registers of the senate, of the 9th of September:

The conservative senate, assembled to the number of members prescribed by the 90th article of the act of the constitution, Frimaire 22, year 8;

Having seen the project of the senatus-consultum drawn up according to the form prescribed by the 57th article of the constitution, of Thermidor 16, year 10;

Having heard, on the motives of the said project, the orators of government, and the report of the special commission appointed on the 15th of Fructidor, year 13, decrees as follows:

Art. I. Counting from the 11th of Nivose next, Jan. 1, 1806, the Gregorian calendar shall be employed throughout the whole of the French empire.

Art. II. The present senatus-consultum shall be transmitted by a message to his imperial majesty.

The president and secretaries,
(Signed) Francis (de Neufchateau) president.
Colaud and Porcher, secretaries.

Seen and sealed,
The Chancellor of the Senate (Signed) Laplace.

The report made to the senate, in the sitting of September 9, 1805, by the senator Laplace, in name of a special commission appointed to examine the project of the senatus-consultum in regard to the re-establishment of the Gregorian calendar:

"SENATORS,

"The project of the senatus-consultum which was presented to you in the last sitting, and on which you are going to deliberate, has for its object the restoration in France of the Gregorian calendar, reckoning from the 1st of January 1806. It is not necessary at present to examine which of all the calendars possible is the most natural and the most simple; we shall only say, that it is neither the one we are about to abandon, nor that which we propose to resume. The orator of government has explained to you with great care

nd disadvantages. The princi-
ndar is in its intercalation. By
f the year at the midnight which
is precedes the true autumnal
n the most rigorous manner, the
aching to the same season the
n they cease to be periods of re-
mposed into days; which must
onology, already too much em-
le of æras. Astronomers, to
sensible, have several times re-
. Before the first bissextile year
w calendar, they proposed to the
iction of the National Conven-
rcalation, and their demand was
that period the convention re-
and, employing itself with in-
s of knowledge, showed to the
nsideration, the remembrance of
will always recollect with lively
ts members, by a noble devotion
of the revolution, preserved from
uments of the sciences and the
pal author of the new calendar,
letters; he drew up, in concert
law by which a regular mode of
ited for the mode before esta-
few days after in a horrid event,
ct of a law was abandoned. It
ary to recur to it, if we preserved
ch, being thereby changed in one
nts, would present the irregularity
in the third year. The suppres-
it experience a more considerable
acility of finding every moment
but at the end of each year the
rbed the order of things attached
decade, which then rendered ad-
ssary. The use of a small inde-
and years, such as the week, ob-
and already that period has been
which, since the highest anti-
is lost, circulates without inter-
, mingling with the successive
ns.

venience of the new calendar is
the

the embarrassment which it produces in our foreign relations, by insulating us in that respect in the midst of Europe; which would always exist, for we ought not to hope that this calendar can ever be universally admitted. Its epoch relates merely to our history: the moment when its year commences is placed in a disadvantageous manner, as it participates in and divides between two years the same operations and the same labours: it has inconveniences which would be introduced into civil life, as the day begins at noon, according to the usage of astronomers. Besides, this custom would relate only to the meridian of Paris. In seeing others reckon the longitude from their principal observatories, can it be believed that they would all agree in referring to the commencement of our year? Two centuries were necessary, and the whole influence of religion, to cause the Gregorian calendar to be generally adopted. It is in this universality, so desirable and so difficult to be obtained, and which it is of importance to preserve when it is acquired, that its greatest advantage consists. This calendar is now that of almost all the nations of Europe and America: it was a long time that of France: at present it regulates our religious festivals, and it is according to it that we reckon our centuries. It no doubt has several considerable defects. The length of its months is unequal and whimsical, the origin of the year does not correspond to that of any of the seasons; but it answers very well the principal object of a calendar, by being easily decomposed into days, and retaining nearly the commencement of the mean year at the same distance from the equinox. Its mode of intercalation is convenient and simple. It is reduced, as is well known, to the intercalation of a bissextile every four years; the suppression of it at the end of each century, for three consecutive centuries, in order to re-establish it at the fourth; and if, by following this analogy, we still suppress a bissextile every four thousand years, it will be founded on the true length of the year. But in its present state, forty centuries would be necessary to remove, only by one day, the origin of the mean year from its real origin. The French mathematicians, therefore, have never ceased to subject to it their astronomical tables, become, by their extreme precision, the base of the ephemerides of all enlightened nations.

One might be afraid that the return of the old calendar would soon be followed by the re-establishment of the old measures. But the orator of government has taken care to dispel that fear. Like him, I am persuaded, that instead of

igious number of different mea-
France and shackled its interior
fully convinced of the utility of
sures, will take the most effectual
use of them, and for overcoming
l to it by old habits, which are
day.

is your commission unanimously
he senatus-consultum presented

AKE AT NAPLES.

duke d'Ascoli, the minister of
d to government the following

e which was felt in this capital,
ngdom of Naples, on the 26th
ng, has occasioned, according to
itherto been received here, the
lamage :—In the capital, several
ents, have been thrown down:
the ruins of the palace of Cor-
e greatly suffered, and threatened
of Caserta, and a number of pri-
nearly in the same proportion:
l. At Nola, a part of the bar-
valry, and several houses, sus-
o lives were lost. At St. Mary
e neighbourhood of Capua), a
ging to the cavalry was almost
even soldiers were killed, and
d. At Nevano, and the envi-
red very little. The town of
allen to ruins, and more than a
l dead in it: a part of the inha-
ng themselves to flight. During
n convulsed every thing, flames
the earth throughout an extent
part of the town sustained no
nce in which Isernia is situated,
raniello, and about seven other
ost similar; but the number of
. In the town of Montefusco
ed; the bell of the collegiate
was killed, and several other
e town of Avellino shared the
same

same fate: some persons and several seminarists perished. The town of Chieti suffered very little: some houses only were damaged. At Salerno the earthquake was strongly felt; but it occasioned very little loss, At Finocella and Mola di Barri, in Apulia, nearly the same scenes took place. In the districts around Vesuvius the earthquake was less felt than elsewhere; the air having found a way to escape through the volcano."

"*Naples August* 10.—Mount Vesuvius has lately made such an eruption, that one similar to it has not been witnessed for a long time: the lava ran down in such quantity, and so rapidly, from the summit of the mountain, that in less than two hours it reached the sea. In its course it divided itself into three parts, which ran between the Torre del Greco and the Torre del Annonziata: on this account it occasioned less damage than if it had fallen in one current on these two towns. It is a lamentable spectacle to see the vines, the corn-fields, and the houses swallowed up in a sea of fire, and covered to the depth of three toises with iron ore; for the lava which ran down on this occasion had absolutely that character. The queen, who was at Castelmare, was not able to return to Naples by land; for the road is covered with three causeways of lava, the least of which is three hundred paces; and it was also impossible for her to go to the theatre of St. Charles, to see the representation given on her birth-day. It is much to be feared that this country will experience the fate of Herculaneum and Pompeii."

Extract of another Letter.—"After the terrible earthquake of the 26th ult. we began to resume a little security; but subterranean noises being heard from Vesuvius, an eruption of the volcano was apprehended, and the inhabitants of Torre del Greco and l'Annonziata removed from their houses, and thought of providing for the safety of their persons and valuables. About a quarter past two in the afternoon Vesuvius made an extraordinary eruption through the same mouth which gave a passage to that in 1794. The latter was even more considerable, having thrown out a current of inflamed lava, which proceeded with great rapidity as far as the plain, over a space of about four miles, and then took its course towards the sea, which it reached in about nine hours.

"It was observed that from its origin this current divided itself into two branches; one in the direction of Portici, which luckily then turned aside, and, uniting itself to the other, formed in the middle a kind of island of boiling lava, which

n the sea; where there was seen
ed up, a kind of promontory of
bout twenty minutes the whole
upied by the lava continued in
may say, a terrible but astonish-
s the inflamed trees presented the
ontrast with those of the volcanic
The lava, as has been said, pro-
nner with great rapidity, carrying
asses; and nothing was seen in a
but boiling foam, and eddies of
persons who were at Portici be-
in boats before the torrent of fire
rs. Happily the habitations ex-
d we have not learnt that any
s fatal event."

August 2d estimate the loss sus-
earthquake of July the 26th at
They add the following parti-
otice to the Neapolitan govern-
rs sent to the spot:—"At Iser-
was so terrible, the earth opened
339 families were swallowed up.
milies perished: at Massino 84:
nt-Angelo-in-Colla, 43: at Bara-
, 142. Lorenzano and Saint-
entirely destroyed. A small river
t province, and which traversed
was lost at the distance of four

VELS, AEROSTATION, &c.

gh, dated August 3, says, "We
urther account of the progress of
by captain Krusenstern. He ar-
he met with a favourable recep-
, M. Resanof, entertains hopes
ended with the best success.

nces has purchased the philoso-
bertson, which is remarkable for
truments, and particularly those
galvanism.

ent which M. Robertson intended
ce from Petersburgh, has been
e bad weather into a common
ascent.

ascent. The wind, which in the morning had a favourable direction, carried the aëronauts with great violence towards the Baltic. They set out from the academy of arts at half after eight, and terminated their voyage at the mouth of the Neva, at about fifty paces from the sea. When M. Robertson descended with his pupil, he resolved to ascend alone in order to cross the gulf; but the peasants having drawn the ropes of the balloon too strongly to one side, the netting slipped from it, and therefore it was impossible for him to carry his design into execution. His imperial majesty was present at this ascent."

ASTRONOMY.

Table of the right Ascension and Declination of Ceres and Pallas for November 1805.

	CERES.					PALLAS.				
	AR.			Decl. N.		AR.			Decl. S.	
1805	h	m	s	°	′	h	m	s	°	′
Nov. 1	7	23	0	23	47	5	16	32	26	8
4	7	24	24	23	56	5	15	52	27	1
7	7	25	36	24	5	5	14	56	27	51
10	7	26	32	24	16	5	13	44	28	38
13	7	27	12	24	27	5	12	20	29	30
16	7	27	36	24	40	5	10	36	30	4
19	7	27	48	24	53	5	8	44	30	43
22	7	27	40	25	7	5	6	36	31	17
25	7	27	16	25	22	5	4	20	31	47
28	7	26	36	25	38	5	1	56	32	13
Dec. 1	7	45	40	25	54	4	59	24	32	34

ZINC.

In our List of Patents, page 95 of our last volume, we mentioned one granted to Messrs. Hobson and Silvester, of Sheffield, for a method of manufacturing zinc. The discovery of these gentlemen is curious. They have found that zinc, at a temperature between 210° and 300° of Fahrenheit, is not only very malleable, but may be passed through rollers or drawn into wire. Zinc does not return to its former partial brittleness after being thus wrought, but continues soft, flexible, and extensible, and may be applied to many uses for which this metal was before thought unfit.

PURE

RE CERUSE.

hat if lead ashes be dissolved in a
te nitric acid, assisted by a gentle
e filtered, and then precipitated by
alpable powder by levigation, the
d and dried, will be the purest and
sible.

DEATHS.

instant, died at his house in Great
53d year of his age, Mr. William
ndscape engraver. He was edu-
o engraved heraldry on plate; but
dscape after Wilson, so as to ob-
Society for the Encouragement of
he precursor of talent of a superior
Paris, at that time the chief se-
study of engraving, for improve-
d successively under Aliamet and
of whom he imbibed the leading
ving which he afterwards adopted
ter he engraved a large plate of a
he manual dexterity of Wille was
obably contributed not much to
he always spoke of Wille's in-

England, the success of Woollett
d set the fashion in that depart-
e disdained to copy what he did
the influence of fashion in art,
ce of his style, and continued to
to his pupils, Nature, Vivares,
the French school.
are after Zuccarelli and Both:
containing probably his best en-
es of Great Britain, after Hearne;
es, after Farington; and Smith's
ief excellence consisting in his
general effect of his chiaro-scuro,
more beneficially employed in
and hence he generally worked
upils, who were latterly his own
manners were unassuming, his
nitting, and his moral character
ent from home, but lived in the
worthy family, who are now de-

The death of the celebrated Klaproth, of Berlin, has been announced in some of the foreign journals. We are happy to state that this intelligence is not correct. He enjoys good health, and is now in his sixty-second year.

M. Justus Klaproth, professor of jurisprudence in the university of Göttingen, well known by the learned works which he has published on that subject, died on the 10th of February last, in his seventy-seventh year.

M. Alexander Saverien, engineer of the French marine, died on the 28th of May last, in his eighty-fifth year. He has been long known to the scientific world by his writings on navigation, and the theory of building, rigging, and manœuvring of ships; accounts of instruments for making observations at sea; his marine dictionary; a dictionary of the mathematics; a dictionary of architecture; history of modern philosophers, and history of the progress of the human understanding. For many of his latter years he was poor and infirm, and was much indebted to the cares of a servant who attended him from attachment. He has left a widow likewise in want, and very aged.

LIST OF PATENTS FOR NEW INVENTIONS.

To John Nyren, of Bromley, in the county of Middlesex, muslin bleacher and tambour worker; for printing fancy patterns on silk and cotton lacenet, instead of tambouring or working them in colours. Dated September 27, 1805.

To Stephen Clubb, of Colchester, in the county of Essex, millwright; for an improved mangle. Dated September 27, 1805.

To James Macnaughtan, of Great Queen-street, Lincoln's Inn Fields, in the county of Middlesex, ironmonger; for a stove or grate and range upon a new construction, by which rooms will be much more effectually warmed than they now are, and the chimneys prevented from smoking. Dated September 27, 1805.

To John Syeds, of Fountain Stairs, Rotherhithe Wall, in the county of Surrey, mathematical instrument maker; for a steering amplitude or azimuth compass and scale for finding and working the course of ships at sea. Dated October 7, 1805.

To Daniel Desormeaux, of Barking, in the county of Essex, surgeon and apothecary, and Samuel Hutchings, of Ilford, in the said parish of Barking, weaver; for their improvements in the making and manufacturing of wax, spermaceti, and tallow candles. Dated October 22, 1805.

LOGICAL TABLE

Y, OF THE STRAND,

ctober 1805.

Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
30·22	35°	Fair
·40	22	Fair
·60	31	Fair
·50	21	Cloudy
·40	25	Cloudy
·30	32	Fair
·21	35	Fair
·25	37	Fair
·32	46	Fair
·32	15	Fair
·28	32	Fair
·05	12	Fair
29·86	17	Cloudy
·55	6	Rain
30·04	27	Fair
29·96	26	Fair
·65	0	Rain
·52	10	Showery
·42	28	Fair
·19	10	Cloudy
·51	0	Rain
·92	24	Fair
30·14	28	Fair
·20	10	Fair
·14	14	Foggy
29·93	30	Fair
·70	15	Fair
·56	10	Cloudy
·46	7	Cloudy
·35	5	Cloudy

ter's height is taken at noon.

XX. *Account of the Goats of Angora: in a Letter from M.* Chancey, *to M.* Pictet, *of Geneva*[*].

The kind of goat which is known in Europe by the name of the Goat of Angora, is not the only one which exists in Natolia and in the environs of this city. We find there also another kind, more common and more resembling that of Europe. Travellers have imperfectly described those two races, which are perfectly distinct; and hence arises the uncertainty that prevails in Europe respecting the products of each. We cannot remove this uncertainty but by a positive description of each of the two races. This distinction will prevent us in future from confounding the short wool of the one kind, which is somewhat like cotton, with the long and silky hair of the other. The two races of goats in the neighbourhood of Angora are known by the names of *kara-gueschy* and *tistik-gueschy*.

1. The *kara-gueschy* or *scys* (or black goat) is the common goat, resembling that of Europe; and is found in Syria, Natolia, and all the East. Its fleece is black, or of a deep brown. The hair is long and straight, sufficiently fine at the end which is fixed in the skin, but more black and coarse at the other end. The kara-gueschy is shorn every year. His hair is of a grosser quality, and is not exported abroad, but employed in these places for making coarse stuffs for tents, and for sacks like our hair sacks. This fleece of Angora is not more valued than the other goat fleeces of the East. Its value in these places is thirty paras for the *ocque* of 400 drachms. Under this hair, and upon the very skin of the animal, there is another fleece finer and shorter. It is composed of slender hairs, of which the length varies from an inch to an inch and a half. These, by their mixture at the root of the longer hairs, form a short wool of a cotton-like substance and of a yellowish gray colour. This part of the fleece, which is by far the most precious, is obtained by throwing water saturated with lime upon the side of the animal while it is yet covered with hair. In a few minutes the hair and the down detach themselves from the skin, and afterwards are easily separated from each other.

The wool of the kara-gueschy is imported rough into Europe, where it is known by the name of Goat's hair. It is employed in different manufactures, particularly in hat-

---

[*] From *Bibliotheque Britannique*, No. 198.

se that Marseilles still continues
his article; and it is to this city
ommerce, and one of the prin-
our manufactures which are

is less abundant in Syria, and
A much greater quantity is
Erzerone, and from the north
of Kerman furnishes the most
all these wools are forwarded
of camels which go from Erze-
are forwarded to Marseilles and
of sea.
wool of the Goat is known
except in those two places, it is
Its value in these places arises
from Europe. At Angora the
to six piastres the ocque of 400

t is also exported rough into
province of Kerman; but it has
the use to which it is put. The
n it. They make shawls of it
but far inferior in fineness and
seems certain that the primary
for the fabrication of the shawls
ce of a goat similar to the kara-
much finer and more precious
into Europe. I do not even
Europe: at least, it has never
leppo, or the other cities of the

tik-Gueschy.

olly goat, forms the second kind
found in Angora. But, instead
urope as the kara-gueschy does,
any respects. It forms in the
erhaps even a distinct species.
oat which Buffon has described
at of Angora. Its fleece is of a
is long, thin, silky, naturally
and unlike the hair of the kara-
as its skin; it is as supple and
f the Spanish Merinos. These
mpose the whole fleece of the

tistik-gueschy, which is as fine at the top as at the roots, and which are not mixed near the skin with any other soft wool or down. This wool or down of which we speak belongs exclusively to the kara-gueschy breed, and is entirely a stranger to the real goat of Angora.

This difference alone furnishes an obvious mark of distinction between the two breeds. There are, besides, many others, of which one is, that the kara-gueschy multiplies its species throughout all the East, while the tistik-gueschy is confined to the soil of Angora. It is found only in this city, or its environs to the distance of 15 leagues. At a greater distance the race is bastardized; the wool becomes coarser, and the value of the animal is much inferior to that which constitutes the riches of the city from which it takes its name.

The territory of Angora is composed of mountains a little elevated, on which the snow generally lies for two months of the year, and which afford numerous springs of fresh and wholesome water. The rivulets which are thus formed fertilize the soil, which is covered with pasture grass. As soon as the cold has abated they conduct the tistik-gueschy to these mountains, where they pass the mild season, changing their pasturage in rotation every day, and continually exposed to the air. It is only on the winter nights that they are allowed houseing in sheepfolds.

The goats of Angora graze in herds of from two hundred to eight hundred in number: the females and bucks mixed indiscriminately. The latter are higher and stronger than the former; their hair is like theirs, white and curled, but not so fine. The flesh of the tistik-gueschy is better than that of the ordinary goat. It is killed for consumption after five years of age; for at this age the hair becomes coarser, and the fleece is less esteemed.

The tistik-gueschy is shorn yearly, after being bathed in running water. Their hair is clipped with long iron scissars. The fleece of the females, which is more esteemed than that of the males, weighs from 350 to 400 drachms. Their fleeces are all spun on the spot; and it is a remarkable fact, that the place consumes their entire product, without allowing any exportation. The reason is, that it is to this manufacture the inhabitants of Angora owe their subsistence, and they are jealous of preserving it.

Nothing is more simple than the process employed at Angora to work the wool of the tistik-gueschy. As soon as the animal is stript, the fleece is combed with a long iron

comb,

re very thickly inserted. The
clear, and disengaged from all
ave adhered to the body of the

ngora whom I have consulted
ie only operation which the hair
clean, and fit for being spun,—
omen are generally intrusted.
staff like that which is used for
a number of hairs into one
three and even two hairs to a
of spinning produces thread so
is sold for twelve parats the
ther kinds of thread diminishes
o or even one parat per drachm.
schy, though thus spun, is yet
gh no operation of dyeing. In
n, and made into a stuff known
the schallet of Angora. These
so great a consumption, are all
ure of this city.
gora there are more than two
employment, and each loom
een workmen. This source of
ngora enjoys, must necessarily
ds not even to the destructive
which has turned to miserable
so flourishing.
eces of 28 piks in length and
hich are sent to dyeing as they
are dyed all manner of colours
shade; but lively reds and vio-
schallet is much superior to
lightness and fineness of its
priced. The most common
ece, the dearest at fifty. This
ned in Constantinople and in

the tistik-gueschy is a suffi-
nents that have been proposed
France. Already some indivi-
en sent to Rambouillet, where
herto the owners have not been
ces. Perhaps the above details
e.

The price of the tistik-gueschy at Angora is from 10 to 12 piastres for the females, and from 12 to 15 for the males. We might easily obtain a little flock. The journey to Aleppo would take from 20 to 24 days in the fair season. From Aleppo it would be proper to send the herd to Lattakrch, and from thence to Cyprus, where vessels for France are always to be found.

It would be necessary for the success of this experiment to make some peasants of the country accompany the flock. They are to be hired at Angora. Their payment, which however it is difficult to calculate exactly, will be altogether more than a thousand piastres per annum.

After having showed the facility of an experiment which might eventually propagate in France a precious breed of animals, and which is not to be found in Europe, it remains to obviate an objection which will undoubtedly be advanced, but which it is of consequence not to leave accredited.

We have seen above, that it is to the salubrity of the waters and the nature of the soil of Angora that the people of this country attribute the fineness of this animal's fleece. In fact, at the distance of more than 15 leagues from Angora this race is not to be found, either on the side of Erzerone or in the other parts of Natolia. The very animals which are sent there degenerate. It might seem, therefore, that it would be impossible to preserve the breed in France. But it is easy to answer this by a recent example, and one actually well known in France: I mean the Merinos of Spain. Who can doubt that suitable care and attention would produce on the goats of Angora the same effect that they have produced on this precious race of animals?

In fact, the same prejudices which prevail at Angora existed and still continue in Spain. The proprietors and the majoros di domos are all persuaded that the pure race of the Merinos belongs exclusively to their soil. They are assured, besides, that the purity of the breed is owing to the continual journeys which their flocks make from the mountains of Leon to those of Andalusia. From this conceit arises the facility with which they allow the breed to be imported for propagation into France. This opinion appears also to be verified in the places themselves; for the Merinos which settle at Segovia, known by the name of *piarras*, degenerate from the first year, and their wool loses there in value from 20 to 25 per cent.

But the consequence drawn from this fact against the possibility

ie breed pure in France is abso-
iot know that the flock of Ram-
of fleece, and superior in size and
pecimens from the Spanish ca-

---

hine by which all the Thread-work
done in a standing Posture. By
of Fettleworth, near Petworth,

re used in my employment, as a
uch in my health, and from the
st either give up my business or
ulty I invented this machine, got
k with it. I found it answer to
followed by a restoration of my
made eighteen hundred or two
ith it, and still work on. I re-
st way of closing all the thread-

to the floor, a little to the left of
n of the hand; the work is held
s to the place."

Summersell, cordwainer, and
chard Hawkins, John Tilly, and
s Tilly, and Edward Hawkins,
above statement; as well as the
Peter Martin, surgeon, at Tul-

nion, that Thomas Holden's in-
sition to men of that profession,
y be diseased internally, or who
veakness and indigestion. These
ed, if not occasioned, by their

twenty years ago, often applied
n of bowel complaints, and fre-
ake the medicines usually em-
pepsia.

---

ociety of Arts, &c. vol. xxii. who awarded
guineas for this invention.

"I repeatedly informed him, that his employment was the cause of his disorder, and desired him to relinquish it, or invent some method to do his work standing. This hint, and his corporeal sufferings, prompted him to the invention. That it answers the purpose, I have reason to believe, as he and others use it. He is now free from complaints, and so improved in his corpulence and countenance, that he is not like the same man, and for years has had no occasion for medicine."

See Plate IV.

A, the bed for the closing-block, and to lay the shoe in, whilst sewing.

B, the closing-block.

C, a loose bed to lay the shoe in whilst stitching; the lower part of which is here exhibited reversed, to show how it is placed in the other bed A.

D, the hollow or upper part of the loose bed C, in which the shoe is laid whilst stitching.

E, a table on which the tools wanted are to be laid.

F, an iron semi-circle, fixed to each end of the bed A, to allow the bed to be raised or depressed. This half circle moves in the block G.

H, another iron semi-circle, with notches, which catch upon a tooth in the centre of the block, to hold the bed in any angle required. This semi-circle moves sidewise on two hooks in staples at each end of the bed.

I, the tail or stem of the bed A, moving in a cylindrical hole in the pillar, enabling the bed to be turned in any required direction, and which, with the movement F, enables the operator to place the shoe in any position necessary.

K, the pillar, formed like the pillar of a claw table, excepting the two side legs being in a direct line, and the other leg at a right angle with them.

L, the semi-circle H, shown separately, to explain how it is connected with the staples, and how the notches are formed.

M, the tail or stem of the bed A, and the lower part of the bed N, shown separately, to explain how the upper part of the bed is raised or depressed occasionally.

Commercial Policy. By
Esq. London.*

so essential to mercantile spe-
lative interference which would
trol the modes of their accom-
ury and wider consequence than
he famous reply, " Leave us to
ench merchants made to the mi-
promoting their prosperity, has
wisdom: but though sufficient
tory of all commercial countries,
ory of our own, to demonstrate
de, no regular attempt has yet
ubject in a clear and distinct
emonstration, it would be neces-
consider the natural tendency of
cond, how far it should be re-
stances. Were this done, and
certain special laws, produced,
overnments attempting to regu-
uld be evident, and a degree of
olitical œconomy, proportioned
btained only inferior to mathe-
ial acts of authority relative to
ither to individuals, or corpora-

tendency to blend the interests
to disseminate throughout the
f mutual dependence. If one
in such a Utopian condition as
diffuse itself without being af-
f the world were raised to a state
of human industry to be appro-
overnments, nor of its popula-
; mankind, at liberty to cultivate
le, would divide themselves into
proximation would be induced
ods, and society would assume
tome may sometimes be traced
tories and colonies;—with this
ither the calamities of war nor
erfering to divert the merchant

---

ted by the Author.

from his speculations, the artist from his profession, or the manufacturer from his industry, a more certain and even result might be expected from the infinite sources of commerce. It is evident that the heaviest oppression on trade is occasioned by state necessities: the armies, and the revenue requisite to support wars and the paraphernalia of nations, are obtained at the expense of its capital and the most efficient instruments of labour. But this expense, great as it is directly, is often increased indirectly by those regulations which governments have promulgated for rendering commercial enterprises subservient to political purposes. Experience has proved that commerce furnishes the most powerful engine of war, and statesmen respect trade only for the aids which it yields in war: it is always with a reference to war that it receives the encouragement of statesmen. The view, for instance, with which the British government has so assiduously encouraged the fisheries, had certainly for its object the rearing of seamen for the navy, as much as the local improvement of the districts contiguous to the fishing stations. The navigation act, while it has tended to increase the number of ships and sailors, and thereby promoted the naval superiority of Great Britain, has been perhaps detrimental to the extension of her trade in general by occupying so much capital in the value of ships of war, and so many men in marine labour. But the navigation act being one of those regulations of trade which arise out of political interests, it leads us to consider the second thing proposed, namely, how far such regulations or restrictions ought to extend; in the consideration of which it may be as well to advert to what ought to be the commercial policy of Great Britain.

The political respectability of Great Britain demands, as essential to her preponderancy, the preservation, perhaps the extension, of her naval superiority. Therefore the attention of government should be directed to foster those branches of trade that will employ or increase her shipping, and at the same time encourage her manufactures. To accomplish this, British commerce must be confined to British ships, and all the articles of Britsh trade permitted to pass wherever the merchant conceives a likelihood of obtaining profit. We must even shake off that antiquated prejudice which still makes a distinction between agriculture and trade, and consider agriculture as only one of the many divisions of trade; we must cease to believe that corn more than any other commodity requires a particular system of laws; and if we can import our corn cheaper than it can be raised

ease to think that a free importa-
nental to our national prosperity.
that a free importation of corn
e rent-rolls of the landholders;
will assert that a reduction of
cause would be a misfortune to
ome of the landholders can only
nt rate by restrictions on the corn
that the landholders are benefited
ion. But granting that the land-
moving the restraints of the corn
e that their misfortune would ul-
ous to themselves; for, to pre-
ortance they might be induced to
their visible capital would possess
r those who are dependent on in-
he fertile tracts of America pre-
n which the British empire should
By limiting the supplies which
ted kingdom might draw from
ns of British vessels, the quantity
d necessarily augment; and the
an advantage in attending more
n navigation, and, gradually relin-
the seas which they are as gra-
the mastery which we still pos-
said, that such a restriction as is
the Americans to countervail us,
produce in British vessels. But
ould rectify; for we are yet suffi-
nerican produce to wait patiently
re. In the present state of Ame-
that agriculture more than com-
he inhabitants; so that the very
come in to the aid of our advan-
cial to them.

that should be considered here.
he commercial policy of Great
commodation to the British mer-
oreign colonies, and to prevent
trading with the British colo-
former we may obtain the latter:
is to increase our shipping, we
tion to foreigners in their own
r desire to become navigators by
Thus the nature of British restric-
tions

tions on trade ought to extend no further than so to press against the commercial systems of other countries as to give them a bias opposite to our own. When more is attempted, the consequences will revert upon ourselves in losses which can neither be calculated nor by any after lenity remedied. But a few facts will more clearly illustrate this truth than any general reasoning, especially if a series can be produced that obviously originated in an act of government. Let us, however, previously consider some of those instances of the folly of partial restrictions on trade, of which the consequences have not been distinctly ascertained, and of which the records are more imperfect.

During a long period the principal trade of Scotland was its fisheries; and the acts of the Scottish legislature, commencing with the reign of the first James of that kingdom, exhibit the unremitted attention which the fisheries received from the government. It would be inconsistent with the limits of an essay to trace here the various effects produced by the different laws which were deemed essential to the improvement of the fisheries: but it is not foreign to the purpose to call the attention of the reader to some of those steps by which the Scottish nation advanced towards that great commercial enterprise the Darien expedition.

From 1424, in which a tax was imprudently levied on the exportation of herrings, till 1493, the Scots appear to have regularly, and with different degrees of success, prosecuted their fisheries. In the year 1493, the naval spirit of that adventurous prince James IV. prompted him to undertake a variety of plans to raise seamen for the navy which he was then building; and, among others, to obtain an act perhaps the most extraordinary in its provisions that ever passed the legislature of any state. Although the 49th cap. of James IV. did not, and indeed could not, produce such a sudden increase of mariners as his impatient genius demanded for its projects, it must be regarded as one of those bold interpositions of authority that generate a successive train of consequences, and become epochs in the history of the affairs to which they relate. By it the boroughs and towns were commanded to build busses and vessels for the fisheries, and to send all idle persons on board. How far this preposterous law was carried into execution is not our present business to examine; it is however well known, that in the reign of James IV., animated by his example and influence, the Scots had reached a high degree of maritime power. We may therefore, without adverting to what may have been done before, presume to say

a foundation was laid for a nursery
and that, though no other record
the subsequent reigns would prove
ued to engage the attention of the
ndoubtedly they would be affected
ormation and of the civil wars, but
which is generally imagined. For
d to industry do not readily enter
s, particularly if their industry be
s, that both the reformation and
ged by the chieftains and their ad-
and towns would, no doubt, take
ion of events during those two tu-
ot to such a degree as the factious
atory clans were incited. There-
he various laws which were passed
I. for the encouragement of the
st regard them as directed to their
tablishment. And when we pass
vents till the year 1694, in which
s projected, we can easily under-
e been then in Scotland a number
e the first to embark in an enter-
fairly an unprecedented reward of
nt with which that expedition was
ith which it was executed, reflects
he Scottish nation as the policy by
disgraces the disposition and reign
nglish and Dutch East India com-
fects of the advantageous situation
cted, influenced William to coun-
d private partialities, and an igno-
s of trade, induced him to destroy
ostering would have extended the
ns. The consequence of William's
in the ruins of the Darien colony;
with the expedition were for ever
fisheries were for many years after
e Dutch in the interval obtained
ence for their herrings in the mar-
tion in the amount of the fisheries
e proper knowledge of the trade
ed, and for nearly a century since
re been annually occupied with
restore that knowledge. It is as
rical truth whatever, that prior to
the

the Darien expedition the Scottish fishers practised the deep-sea herring-fishery, which the Dutch have so long so successfully followed; and it is equally well known to every one who has at all attended to the subject, that such has been the total ignorance of that method of fishing among the Scots, that up to the last year not one vessel was fitted out from any port in Scotland for many years before. It is, however, with no small degree of satisfaction, that I have it in my power to be the first to record that several vessels are this year equipped for that purpose from the Clyde. But the diminution of the trade, and the loss of the requisite knowledge, did not close the effects of William's interference with the Darien expedition; the revenue of the kingdom is burthened with heavy bounties, that can only be described as the means of prolonging the precarious loch fishery; and large sums are annually voted to force upon the inhabitants of the Highlands of Scotland that industry and civilization which would probably have gradually arisen from the extensive commerce that would have flowed in upon the mother country from the Darien colony.

Independent of the pecuniary consequences of impolitic restrictions on trade, they are often the cause of political evils also. The American war, and all that has resulted from the consolidation of the United States, will be found to have originated in those severe limitations with which the trade of the colonies was harnessed to forward the prosperity of the mother country, although the separation of the colonies has been ascribed to the financial schemes of the British ministry. The spirit, as well as the letter, of the navigation law was enforced upon the colonies with a degree of rigour altogether obnoxious to the free genius of trade. The colonies were compelled to send their produce to Great Britain in vessels belonging to British subjects, and from Great Britain the rest of the world was supplied with Anglo-American produce. By this restriction the colonies were obliged to furnish themselves from British markets with the necessaries or luxuries that they required, which being of greater value than their produce, in time accumulated a debt against them to so great an amount, that to be released from it formed the reason, and the tax-bills furnished the pretext, for throwing off the yoke of the mother country. Had the British government, instead of expecting to draw from the colonies a direct revenue, made such political arrangements as would have allowed them to trade immediately with the states of Europe, we should not now have been consoling ourselves with the absurd assertion,

nirteen provinces was a benefit to the
onies been permitted to trade imme-
of Europe, a flow of wealth would
that ultimately would have assisted
who, instead of holding her sove-
ne slender tie of opinion, might have
s internal taxation, such a formida-
nerica as would have prevented the
, and in periods of necessity would
with the greatest effect. But from
ons let us turn to the consideration
that the mercantile machine of our
only one that has been deranged by
statesmen, I am induced to quote an
's of Russia that is most distinct and

he iron mines of Russia, about the
their heads that the immense forests
re diminishing so rapidly, that un-
timber were prohibited a scarcity of
l they infected the government with
onsequence of which the exportation
lly prohibited. The British vessels
, obtain deals to make up their car-
ore obliged to take a larger quantity
hich was raised so high that it could
quate profit in the British markets;
f Russian iron consumed by Great
lly decreasing for several years be-
astened the diminution. In the year
ne imported from Petersburgh nearly
1804 the quantity was under 6000.
this measure of the Russian govern-
at law of ours, which was passed in
nsurance of French vessels, or their
ry during the war with France; in
egular offices of insurance were esta-
the principal ports of France; and
red between the two countries, the
vay so readily to their own insurance
fter regained that part of their com-
we formerly received in premiums.
much time in quoting detached in-
limiting the modes and objects of
to show that the country gentlemen
ow-minded jealousy of the progress
which

which the Irish had made in agriculture and farming, towards the close of the 17th century, have abridged, beyond the possibility of remedy, the staple of England, her woollen manufactures. In the reign of Charles II., conceiving the produce of their estates considerably reduced in value by the free importation of cattle and grain from Ireland, they succeeded in setting aside the general interest of the country by obtaining a law to prohibit the importation of such commodities. The Irish, being thus prevented from importing into England, were obliged to salt what they could not find consumption for at home, and export it to other countries for a market; by which that great branch of Irish trade, the exportation of salted provisions, was established. It was long, however, before a sufficient foreign consumption could be obtained, so that their sheep were allowed to increase for the sake of wool alone; by which that commodity was rendered much cheaper in Ireland than in England. The cheapness of wool in Ireland enabled the Irish to set up woollen manufactures of their own, which soon rivalled those of England; so that the English merchants, finding themselves equalled by the Irish, brought down another misfortune upon the general interests of the country. In 1699 an act was passed to prohibit the exportation of woollen manufactures from Ireland to any place except to England and Wales; even to England and Wales the exportation was so unmercifully restricted that this was an indulgence in words only: the consequence was, that many of the Irish manufacturers were obliged to seek employment in foreign countries; and the greater number went to France: by them the woollen manufactures of that kingdom were established, and by their connection a clandestine exportation of wool from Ireland was carried on; so that the French soon made sufficient cloth for themselves, and became our rivals in foreign markets.

It is therefore evident, both from the nature of the thing, and the variety and number of instances which might be given, that freedom is not more essential to commerce than immediate legislative interference is pernicious. Mankind are always regulated in their undertakings by the character of existing circumstances; and the objects of trade vary with political occurrences, which, generally originating from causes the most obscure, are placed beyond the control of preconcerted schemes, and frequently exhibit the reverse of their prospective estimate. Hence it is that laws foundde on particular incidents, and intended to promote temporary purposes

olument, must in their operation
from what are previously supposed,
ls of events of incalculable extent

---

on of Tin in part decomposed into
d Tin. By M. Bucholz*.

nce, in the view of preparing the
seven pounds of the finest English
† of muriatic acid weighing 1·120.
there still remained from 2 to 2½
ed. The next day the matter was
quid had the consistency of syrup.
a pound of water ‡, which swam
he end of an hour, while I exa-
served with astonishment that the
icularly its running particles, were
f lances, needles, blades, &c. of
n length from a quarter of an inch

ome time after repeated the opera-
to see the same appearance again
imself, by all possible trials, that
was absolutely pure. The author
tions of this phænomenon, which
found in opposition to the rules
f Kant on the perfect equilibrium
ition, or the perfect equilibrium
osition. This theory is, however,
iction with experience, inasmuch
nsideration the determinative force
of which the authors have under-
stry in general.
different explanations of M. Bu-
appeared to us satisfactory.

---

ournal, vol. vi.
he author says sixteen.
nce it is called two pounds.

XXIV. *On*

XXIV. *On muscular Motion. By* ANTHONY CARLISLE, *Esq. F.R.S.: being the Croonian Lecture. Read before the Royal Society November* 8, 1804.

ANIMAL physiology has derived several illustrations and additions from the institution of this lecture on muscular motion, and the details of anatomical knowledge have been considerably augmented by descriptions of muscular parts before unknown.

Still, however, many of the phænomena of muscles remain unexplained, nor is it to be expected that any sudden insulated discovery shall solve such a variety of complicated appearances.

Muscular motion is the first sensible operation of animal life: the various combinations of it sustain and carry on the multiplied functions of the largest animals: the temporary cessation of this motive faculty is the suspension of the living powers, its total quiescence is death.

By the continuance of patient, well-directed researches, it is reasonable to expect much important evidence on this subject; and, from the improved state of collateral branches of knowledge, together with the addition of new sources and methods of investigation, it may not be unreasonable to hope for an ultimate solution of these phænomena, no less complete and consistent than that of any other desideratum in physical science.

The present attempt to forward such designs is limited to circumstances which are connected with muscular motion, considered as causes, or rather as a series of events, all of which contribute, more or less, as conveniencies or essential requisites to the phænomena; the details of muscular applications being distinct from the objects of this lecture.

No satisfactory explanation has yet been given of the state or changes which obtain in muscles during their contractions or relaxations; neither are their corresponding connections with the vascular, respiratory, and nervous systems sufficiently traced. These subjects are therefore open for the present inquiry; and although I may totally fail in this attempt to elucidate any one of the subjects proposed, nevertheless I shall not esteem my labour useless, or the time of the Royal Society altogether unprofitably consumed, if I succeed in pointing out the way to the future attainment of knowledge so deeply interesting to mankind.

The muscular parts of animals are most frequently composed

in addition to those which are
ross state they constitute a flexi-
hose texture is generally fibrous,
into fasciculi, or bundles, of va-
res are elastic during the con-
r death, being capable of exten-
of their length, and of return-
ate of contraction.

, appears to belong to the enve-
membrane, and it may be safely
natter of muscle is not elastic.

on, in the parts of muscle, is
f the fibres, it being double that
se, direction.

ble of reiterated contractions and
be alive, or to possess irritabi-
organ for its functions. Irrita-
roughout the present lecture, as

ed to be irritable, their cohesive
of their fibres is diminished, but
transverse direction.

frog attached to the pelvis being
f them was immersed in water,
ng two minutes; when it ceased
bones were broken in the mid-
uscles, and a scale affixed to the
passed between the thighs was
apparatus. Weights were gra-
h scale, until, with five pounds
h was ruptured across the fleshy

ined six pounds weight avoirdu-
the same manner. This experi-
frogs, where one limb had been
of opium, and on another where
l* was employed: in each expe-
ustained a weight one-sixth hea-

n confirmation of these experi-
act more powerfully or more ra-
strength of the sustaining parts,
re their fleshy fibres, but break
intervening bone, as in the in-

---

aves of the *prunus lauro-cerasus.*

stances of ruptured tendo achillis, and fractured patella. Instances have, however, occurred, wherein the fleshy bellies of muscles have been lacerated by spasmodic actions; as in tetanus the recti abdominis have been torn asunder, and the gastrocnemii in cramps; but in those examples it seems that either the antagonists produce the effect, or the over-excited parts tear the less excited in the same muscle. From whence it may be inferred, that the attraction of cohesion in the matter of muscle is considerably greater during the act of contracting, than during the passive state of tone, or irritable quiescence; a fact which has been always assumed by anatomists from the determinate forces which muscles exert.

The muscular parts of different classes of animals vary in colour and texture, and not unfrequently those variations occur in the same individual.

The muscles of fishes and vermes are often colourless, those of the mammalia and birds being always red: the amphibia, the accipenser, and squalus genera, have frequently both red and colourless muscles in the same animal.

Some birds, as the black game*, have the external pectoral muscles of a deep red colour, whilst the internal are pale.

In texture, the fasciculi vary in thickness; and the reticular membrane is in some parts coarse, and in others delicate: the heart is always compacted together by a delicate reticular membrane, and the external glutæi by a coarser species.

An example of the origin of muscle is presented in the history of the incubated egg; but whether the rudiments of the punctum saliens be part of the cicatricula organized by the parent, or a structure resulting from the first process of incubation, may be doubtful: the little evidence to be obtained on this point seems in favour of the former opinion; a regular confirmation of which would improve the knowledge of animal generation by showing that it is gemmiferous. There are sufficient analogies of this kind in nature, if reasoning from analogies were proper for the present occasion.

The punctum saliens, during its first actions, is not encompassed by any fibres discoverable with microscopes, and the vascular system is not then evolved, the blood flowing forwards and backwards, in the same vessels. The commencement of life in animals of complex structure is, e the ultimate organization of

---

* *Tetrao tetrix.* Linn.

scles of birds are formed out of
, and the atmospheric air, acted
ture. The albumen of a bird's
ing incubation, and the vitellus
hat the albumen contains the
ls of the animal thus generated;
uscular parts, which constitute
ch animals when hatched, are
a small portion of the vitellus,
all quantities of the whole com-

e not different, in any respect,
the class of mammalia.
of muscular fibres is generally
re connected with membrane,
lymphæducts; which seem to
enience to the essential matter

repared by washing away the
ces, and exposed to view in a
doubtedly a solid cylinder, the
r membrane, and the contained
ularly granulated, and of little

sisted among anatomists, con-
f muscles; and, because of their
considered them infinitely di-
ay be contradicted at any time
icroscope.
piously upon the reticular coat
in warm-blooded animals these
acity to admit the red particles
c matter of muscle, contained
, has no red particles.
nastomose with corresponding
ontinuous canal cannot be sup-
ner upon the matter of muscle.
minating in the muscular fibre
nges of increase in the bulk or
lenishment of exhausted mate-
uries: some of these necessities
ntinually operating. It is well
of the blood is not essential to
e mode of distribution of the
blood-

blood-vessels, and the differences in their size, or number, as applied to muscles, can only be adaptations to some special convenience.

Another prevalent opinion among anatomists is, the infinite extension of vascularity, which is contradicted in a direct manner by comparative researches. The several parts of a quadruped are sensibly more or less vascular, and of different contextures: and admitting that the varied diameter of the blood-vessels disposed in each species of substance, were to be constituted by the gross sensible differences of their larger vessels only; yet, if the ultimate vessels were in all cases equally numerous, then the sole remaining cause of dissimilarity would be in the compacting of the vessels. The vasa vasorum of the larger trunks furnish no reason, excepting that of a loose analogy, for the supposition of vasa vasorum extended without limits. Moreover, as the circulating fluids of all animals are composed of water, which gives them fluidity, and of animalized particles of defined configuration and bulk; it follows, that the vessels through which such fluids are to pass must be of sufficient capacity for the size of the particles, and that smaller vessels could only filtrate water devoid of such animal particles: a position repugnant to all the known facts of the circulation of blood, and the animal œconomy.

The capillary arteries, which terminate in the muscular fibre, must be secretory vessels for depositing the muscular matter, the lymphæducts serving to remove the superfluous extravasated watery fluids, and the decayed substances which are unfit for use.

The lymphæducts are not so numerous as the blood-vessels, and certainly do not extend to every muscular fibre: they appear to receive their contained fluids from the intersticial spaces formed by the reticular or cellular membrane, and not from the projecting open ends of tubes, as is generally represented. This mode of receiving fluids out of a cellular structure, and conveying them into cylindrical vessels, is exemplified in the corpora cavernosa and corpus spongiosum penis, where arterial blood is poured into cellular or reticular cavities, and from thence it passes into common veins by the gradual coarctation of the cellular canals.

In the common green turtle, the lacteal vessels universally arise from the loose cellular membrane, situated between the internal spongy coat of the intestines and the muscular coat. The cellular structure may be filled from the lacteals, or the lacteals from the cellular cavities. When

hes of the lymphæducts retro-
man leg, I saw, very distinctly,
els terminating in the angles of
icksilver trickled. The prepara-
ving of the appearance made at
ved, by many experiments, that
or the veins have any valves in

muscles separate from the same
nerves which are distributed in
or sensation; but a greater pro-
riated to the voluntary muscles
es, the organs of the senses ex-

arise from the parts formed by
eat masses of the brain, called
m, and from the extension of
he canal of the vertebræ. An-
which are not subject to the
uliar nerves; they are much
he bulk of the parts on which
ose of the voluntary muscles;
hite opake medullary substance
unite their fibrils, forming nu-
l the other nerves of the body,
ed to the organs of the senses.
everal of these junctions, called
omposed of a less proportion of
d their texture is firmer than

of nerves have been usually con-
on: by accurate dissection, how-
ying-glasses, the extreme fibrils
s far as their sensible properties,
l. The fibrils cease to be sub-
sible to the naked eye, in the
animals; and the spaces they
here they seem to end, leave a
noccupied by those fibrils. The
ose their opacity, the medullary
d transparent, the enveloping
l, and the whole fibril is desti-
ry to preserve its own distinct-
ed and mingled with the sub-
Thus the ultimate terminations
ordinary sensation, appear to be,
in

in the reticular membrane, the common covering of all the different substances in an animal body, and the connecting medium of all dissimilar parts.

By this simple disposition, the medullary substance of nerve is spread through all organized, sensible, or motive parts, forming a continuity which is probably the occasion of sympathy. Peculiar nerves, such as the first and second pairs, and the portio mollis of the seventh, terminate in an expanse of medullary substance which combines with other parts and membranes, still keeping the sensible excess of the peculiar medullary matter.

The peculiar substance of nerves must in time become inefficient; and, as it is liable to injuries, the powers of restoration, and repair are extended to that material. The reunion of nerves after their division, and the reproduction after part of a nerve has been cut away, have been established by decisive experiments. Whether there is any new medullary substance employed to fill up the break; and, if so, whether the new substance be generated at the part, or protruded along the nervous theca from the brain, are points undetermined: the history of the formation of a fœtus, the structure of certain monsters, and the organization of simple animals, all seem to favour the probability that the medullary matter of nerves is formed at the parts where it is required, and not in the principal seat of the cerebral medulla.

This doctrine, clearly established, would lead to the belief of a very extended commixture of this peculiar matter in all the sensible and irritable parts of animals, leaving the nerves, in their limited distribution, the simple office of conveying impressions from the two sentient masses with which their extremities are connected. The most simple animals, in whom no visible appearances of brain or nerves are to be found, and no fibrous arrangement of muscles, may be considered of this description: Mr. John Hunter appeared to have had some incomplete notions upon this subject, which may be gathered from his representation of a materia vitæ in his Treatise on the Blood, &c. Perhaps it would be more proper to distinguish the peculiar matter of muscle by some specific term, such, for example, as materia contractilis.

A particular adaptation for the nerves which supply the electrical batteries of the torpedo and and gymnotus, is observable on the exit of each from the skull; over which there is a firm cartilage acting as a yoke, with a muscle affixed to it, for the obvious purpose of compression; so bably governs the operations of

and brain is very similar in all
als.
of animals is not more varied

he limitation of its existence,
ives, and the habits it is des-
nd all of them, so many indica-
mplicity of their internal struc-
the number of organs, and of
he different classes of animals:
ystems, the respiratory and di-
r procreation, and the instru-
lly varied, and adapted to the
his modification of anatomical
lowest tribes of animals until
homogeneous substance. The
is indifferently the internal or
nay be inverted, and still con-
mbs, or tentacula, may be cut
erated without apparent incon-
: the whole animal is equally
qually alive: its procreation is
is pervaded by the nutritious
on by the respiratory influence,
e of motion, and of altering its
st neither blood-vessels, nerves,
overable by any of the modes of
ted.
al (if such a term may be ad-
frame, the variety of accessory
ich a complicated machinery is
narks of design, and of accom-
which fix the order of nature.
animals there are parts adapted
ch of their materials not being
of some liable to be dispensed
sed throughout the intersticial
; the combinations with lime in
he horns, hoofs, spines, hairs,
rings, are all of them, or the
stance, extra-vascular, insensi-
animal functions after they are
an opinion, grounded on exten-
more parts of animal bodies
may

may be considered as inanimate substances; even the reticular membrane itself seems to be of this class, and tendons, which may be the condensed state of it: but these particulars are foreign to the present occasion.

The deduction now to be made, and applied to the history of muscular motion, is, that animated matter may be connected with inanimate: this is exemplified in the adhesions of the muscles of multivalve and bivalve shellfish to the inorganic shell, the cancer Bernhardus to the dead shells of other animals, and in the transplantation of teeth. All of which, although somewhat contrary to received opinion, have certainly no degree of vascularity, or vital connection with the inhabitant; these shells being liable to transudations of cupreous salts and other poisonous substances, whilst the animal remains uninjured. A variety of proofs to the same effect might be adduced, but it would be disrespectful to this learned body to urge any further illustrations on a subject so obvious.

The effects of subdivision, or comminution of parts among the complicated organized bodies, is unlike that of mineral bodies: in the latter instance, the entire properties of the substance are retained, however extensive the subdivision; in the former substances, the comminution of parts destroys the essential texture and composition, by separating the gross arrangements of structure upon which their specific properties depend. From similar causes it seems to arise, that animals of minute bulk are necessarily of simple structure: size alone is not, however, the sole cause of their simple organization, because examples are sufficiently numerous wherein the animal attains considerable bulk, and is of simple structure, and *vice versâ*; but, in the former, the medium in which they live, and the habits they assume, are such as do not require extensive appendages, whilst the smaller complex animals are destined to more difficult and more active exertions. It may be assumed, however, as an invariable position, that the minutest animals are all of simple organization.

Upon a small scale, life may be carried on with simple materials; but the management and provisions for bulky animals, with numerous limbs, and variety of organs, and appendages of convenience, are not effected by simple apparatus: thus the skeleton which gives a determinate figure to the species, supports its soft parts, and admits of a geometrical motion, is placed interiorly, where the bulk of the animal admits of the bones being sufficiently strong, and yet light enough for the moving powers; but the skeleton is

the body is reduced below a cer-
he movements of the animal are
nd; in which last case the bulk
e examples of testaceous vermes,
s most other insects, are univer-

ularity of the crystalline lens of
ed by a learned member of this
unded; as the arrangement of
r of muscle, from the centre to
ens, and these compacted into
duce specific alterations in its

e history of muscular structure
e Royal Society to introduce the
easonings which are to follow:
o much exactness as becomes a
the intention already stated, and
ffered as the apology.
ential influence over the actions
cessary that the same tempera-
uscles during their actions; nei-
the muscular parts of the same
m temperatures for the due per-
ctions.
classes of animals are endowed
cing thermometrical heat, since
n the amphibia, pisces, vermes,
Hunter; a fact which has been
ence: the term *cold-blooded* is
he ratio of this power is not,
es, sufficient to preserve their
l climates; so that they yield to
here, or the medium in which
em become torpid, approaching
ter. Even the mammalia and
resisting certain limited degrees
as well as their limbs, being
rincipal blood-vessels, the mus-
ubject to considerable variations
fluence of which is known.
als which have little power of
remarkable differences in the
nd in the composition of their
and aves.
known causes which influences
the

the temperatures of animals: where these organs are extensive, the respirations are performed at regular intervals, and are not governed by the will, the whole mass of blood being exposed to the atmosphere in each circulation. In all such animals living without the tropics, their temperature ranges above the ordinary heat of the atmosphere, their blood contains more of the red particles than in the other classes, and their muscular irritability ceases more rapidly after violent death.

The respirations of the animals denominated cold-blooded are effected differently from those of high temperature; in some of them, as the amphibia of Linnæus, the lungs receive atmospheric air, which is arbitrarily retained in large cells, and not alternately and frequently changed. The fishes, and the testaceous vermes, have lungs which expose their blood to water; but whether the water alone, or the atmospheric air mingled with it, furnish the changes in the pulmonary blood, is not known.

In most of the genera of insects the lungs are arborescent tubes containing air, which, by these channels, is carried to every vascular part of the body. Some of the vermes of the simpler construction have no appearance of distinct organs; but the respiratory influence is nevertheless essential to their existence, and it seems to be effected on the surface of the whole body.

In all the colder animals the blood contains a smaller proportion of the red colouring particles than in the mammalia and aves: the red blood is limited to certain portions of the body, and many animals have none of the red particles.

[To be continued.]

XXV. *Account of Mr.* ARTHUR WOOLF'S *new Improvements on Steam-Engines.*

IN our nineteenth volume, p. 133, we gave a short account of a former improvement made by Mr. Woolf on the steam-engine, founded on a discovery that steam, of any higher temperature than that of boiling water, if allowed to pass into another vessel kept at the same temperature as the steam itself, will expand to as many times its volume, and still be equal to the pressure of the common atmosphere, as the number of pounds which such steam, before being allowed to expand, could maintain on each square inch of a safety-

atmosphere : for example, that
m of the expansive force of 20,
e inch of a common safety-valve,
0 times its volume, and still be
iosphere, or capable of producing
he piston of a steam-engine to
the old engine (with a counter-
be carried into the vacuous part
proved engines first brought into
nd Watt.
iscovery Mr. Woolf was enabled
he chose), and with complete
necessary than to admit high
ds the square inch, into one cy-
ts expansive force, and then to
ss into, and expand itself in, an-
es the size of the first, there to
ie common way. Or with only
a proportionally small quantity
the boiler, Mr. Woolf found
lerable saving in fuel.
nt of Mr. Woolf, though the
considerable length, it was still
trength of materials; for in the
n there must always be some
Ir. Woolf, however, by a happy
viated every danger of this kind,
dvantage of the expansive prin-
er whatever. This he effects by
eam the additional temperature
sion, *after the steam is admitted*
which is heated by means ade-
be obtained; and the advantage
ectually secures by a most inge-
piston. It may be easily con-
gh rarity as Mr. Woolf employs,
tive with the piston in common
ts rarity so must be the facility
would escape, and pass by the
uous part of the cylinder: but
ems perfectly adapted to prevent
portion of the steam.
ents on the common steam-en-
ans to apply the same principles
the name of Savary's, in such
a way

a way as to render the same a powerful and œconomical engine for a great variety of purposes.

Such is the outline of Mr. Woolf's improvements on this most useful engine: but, for the general information of practical engineers, we shall here subjoin a more technical description, in Mr. Woolf's own words, extracted from his specification of his patent.

"I have found out and invented a contrivance, by which the temperature of the steam vessel or working cylinder of a steam-engine, or of the steam vessels or cylinders where more than one are used, may be raised to any required temperature, without admitting steam from the boiler into any surrounding receptacle, whether known by the name of a steam case, or by any other denomination. That is to say, instead of admitting steam of a high temperature into such receptacle or steam case, which is always attended with a risk of explosion proportioned to the elasticity of the steam employed, I put into the said surrounding receptacle, or case, oil or the fat of animals, or wax, or other substances capable of being melted by a lower temperature than the heat intended to be employed, and of bearing that heat without being converted into vapour: or I put into the said case or cases mercury or mixtures of metals, as of tin, bismuth, and lead, capable of being kept in a state of fusion in a lower temperature than that intended to be employed in working the steam-engine; and I so form the surrounding case or cases as to make it or them admit the aforesaid oil, or other substance employed, to come into contact not only with the sides of the steam vessel or vessels, or working cylinder or cylinders, but also with the bottom and top of the same, so that the whole may be as much as possible maintained at one uniform temperature; and this temperature I keep up by a fire immediately under or round the case or cases that contains the aforesaid oil or other substance, or by connecting the said case or cases with a separate vessel or vessels, kept at a proper temperature, filled with the oil or other substance made use of as aforesaid. In some circumstances, or whenever the same may be convenient or desirable, I employ the fluid metals, or mixtures of metals, and oil or other of the substances before enumerated, at one and the same time in the same engine: that is to say, in the part of the case or vessel exposed to the greatest action of the fire, I sometimes have the aforesaid metals or mixtures of metals, and in the parts less exposed to the action of the fire, I put oil, or other substances capable ite heat without being converted

and method of applying the sur-
obviate the necessity of employ-
sive force round the steam vessel
cylinder or cylinders, as already
em at the temperature required,
n from steam of a comparatively
from water itself admitted into
, all the effects that can be ob-
gh temperature, without any of
oduction of the latter is accom-
iler and other parts of the ma-
lives of the workmen; for such
(but in every case steam is pre-
to a steam vessel or vessels, or
ers, kept at the requisite higher
ntioned means, will there be ex-
d, and produce an effect in the
ch cannot otherwise be obtained
fuel, or with the risk of an ex-
can make use of steam expanded
any given temperature, without
g the steam of any greater elas-
pressure of the common atmo-

which I make use of in steam-
hod of preventing, as much as
y of the steam from that side of
upon by the said steam to the
to the condenser; and this I ef-
s known by the name of double
n or above the piston mercury
an altitude equal to the pressure
of this arrangement will appear
what must take place in working
e piston is ascending, that is,
l below the piston, the space on
to the condenser, the steam en-
the side of the piston is met and
e column of metal equal or su-
nd during the down stroke no
ithout first forcing all the metal
t is called a single engine, a less
al is required, because the steam
always

always acts on the upper side of the piston. For single engines, oil, or wax, or fat of animals, or similar substances, in sufficient quantity, will answer the purpose, if another improvement, which constitutes part of my said invention, be applied to the engine, namely, to take care that in either the double or single engine so to be worked, the outlet that conveys the steam to the condenser shall be so posited, and of such a size, that the steam may pass without forcing before it or carrying with it any of the metal or other substance employed, that may have passed by the piston; taking care at the same time to provide another exit for the metal or other substance collected at the bottom of the steam vessel or working cylinder to convey the same into a reservoir kept at a proper heat, whence it is to be conveyed to the upper side of the piston by a small pump worked by the engine or by any other contrivance. In order that the fluid metal or metals used with the piston may not be oxidated, I always keep some oil or other fluid substance on its surface, to prevent its coming in contact with the atmosphere; and to prevent the necessity of employing a large quantity of fluid metal, I generally make my piston of the depth of the column required, but of a diameter a little less than the steam vessel or working cylinder, excepting where the packing or other fitting is necessary to be applied; so that, in fact, the column of fluid metal forms only a thin body round the piston. In some cases I make a hollow metallic piston, and apply an altitude of fluid metal in the inside of the same, to press its outside into contact with the steam vessel or working cylinder.

" It may be necessary, however, to state, that in applying my improved method of keeping the steam vessels of steam-engines at any required temperature to the engine known by the name of Savary's, in any of its improved forms, in which a separate condenser has been introduced, I sometimes employ oil (or any other substance lighter than water, and capable of being kept fluid in the temperature employed, without being converted into vapour,) in the upper part of the tube or pipe attached to the steam vessel; by which means steam of any temperature may be used without being exposed to the risk of partial condensation by the admission of any colder body into the steam vessel; for the oil, or other substance employed for this purpose, soon acquires the requisite temperature; and to prevent unnecessary escape of heat, I construct of, or line with, an imperfect conductor of heat, that part of the tube or pipe attached to the steam vessel which may not be heated exteriorly.

s is already the practice in some
ot exclusively claimed by me,)
the engine to pass off through
n the one attached to the steam
h it at some part lower than the
loyed in it is ever suffered to de-
the engine. The improvement
ned, of introducing oil into the
vessel of such engines, may also
ying heat externally to the steam
t of the effect which would other-

---

tter from M. Rinck, *of Treysa,* l in Alkaline Prussiates*.

quainted with the Prolusions of
ve verified the most part of his
h to know how you have judged
, this author and his book were
. They rejected indiscriminately,
ll that M. Winterl had advanced.
nave been discussed, and people
His system has now many sup-
all accounts, considerable atten-

of Winterl, we find the follow-
and carbonate of potash there
s in alcohol, does not precipitate
blue but in a red colour, and is
m prussiate of potash by its other
Prussian lixivium has been care-
hemists, none of them has recog-
it is found in it; and I myself
cupied at this moment in a train
ject, as well as on the formation
e already afforded some interest-
omise to furnish me with some

hich I examined offered me some
Weak acids exercise hardly any
this iron. They require for this
to be concentrated. The nitric

---

ons's Journal, vol. vi.

acid was decomposed, and nitrous gàs was disengaged. From the sulphuric and muriatic acids hydrogen were evolved. This fossil blackens at a red heat. The carbonic acid was decomposed, and disengaged itself under the form of gaseous oxide of carbon; and the iron became still more oxidated. This metal is found in the carbonate at the minimum of oxidation, and under the form of white oxide*.

It would be difficult, considering the concomitant disengagement of the other gases, to determine justly what is contained in the carbonic gas of this carbonated iron.

We know that Morecchini has found fluoric acid in fossil elephants' bones. Does not this fact, which is confirmed by Klaproth, lead us to suspect that phosphoric acid transforms itself into fluoric acid? Many appearances come in aid of this suspicion, and, among others, the property of phosphoric acid to corrode glass: the common property of fluates and phosphates of lime to yield a pyrophoric light, &c. The observations made by Gehlen on the occasion of his trials upon æther with fluoric acid, deserve on this account an equal attention. And Klaproth, in analysing the topaz, in which he found 0·05 — 0·07 parts of fluoric acid, has observed another fact, which is particularly remarkable, viz. that the loss which this fossil undergoes by ignition is always more considerable in crucibles of lead than of clay; although, after the observations of Guyton on the bad quality of carbons for conducting heat, one would have expected a contrary effect, which appears to indicate that in the former crucibles the topaz undergoes another action than that of fire.

XXVII. *Chemico-Galvanic Observations. By M.* Oersted †.

I have lately discovered a Galvanic phænomenon hitherto unknown. I was led to it by an experiment of M. Ritter, published some years ago. This philosopher had found that

---

* There is in this department, in the neighbourhood of Jodogne, a mine of vitriol of iron in great crystalline masses perfectly transparent and colourless, which, by its appearance, one would take for Glauber's salts. The earth which surrounds this salt consists, in that part of it which is not in contact with the air, almost entirely of black oxide of iron. The salt itself, when it is dissolved, becomes green by its being exposed to the air, after which it is precipitated by the same alkalis under the ordinary colour. My colleague De Roover, who has made me acquainted with this salt, has received solid masses of it many pounds in weight.—V. M.

† From *Van Mons's Journal*, vol. vi.

pile held in the flame of a taper
of soot, which on the negative
etation, and on the positive wire
be supposed from this that all
companied with a similar phæ-
self of this, I put the two poles
tion with two solutions of the
sitive side the oxide of lead was
our: on the negative side it was
a form similar to the figures of
and the reduced metal formed a
form of the oxide was like the

iments on the commotion which
Ritter had remarked that this
on the positive side, and more
le. I have repeated this experi-
med: however, to assure myself
e existence of the effect, I made
algamation of lead, which I kept
I let the water cool in commu-
f the pile, and I remarked that
the amalgamation was consoli-
wards the negative. This fact,
other phænomena observed by
of the positive side inflames the
hat of the negative side melts
gen pole excites a sensation of
ole does not, but rather excites a

Aquatinta Engraving; with a
atus to prevent the Inconvenience
from the Fumes which are pro-
e Acid employed in the Process.

f the present article is to describe
the title. Some of our readers
by finding along with it some
ch the contrivance is proposed to
sert here the best description we
ng that branch of engraving, ex-
on of Dr. Rees's Cyclopædia.
invented by Le Prince, a French
artist,

artist, who for a long time kept his process a secret. It has, however, been much improved since. It consists in corroding a copper-plate with aquafortis in such a manner that an impression from it has an appearance very much resembling a drawing in Indian ink. "This is effected by covering the copper with a powder or some substance which takes a granulated form, so as to prevent the aquafortis from acting where the particles adhere, and by this means cause it to corrode the copper partially and in the interstices only. When these particles are extremely minute, and near to each other, the impression from the plate appears to the naked eye exactly like a wash of Indian ink. But when they are larger, the granulation is more distinct; and as this may be varied at pleasure, it is capable of being adapted with great success to a variety of purposes and subjects.

"This powder or granulation is called the aquatinta grain, and there are two general modes of producing it.

"We shall first describe what is called the powder grain, because it was the first that was used. Having etched the outline on a copper-plate prepared in the usual way by the coppersmith, (for which see the article *Etching*,) some substance must be finely powdered and sifted which will melt with heat, and when cold adhere to the plate, and resist the action of aquafortis. The substances which have been used for this purpose, either separately or mixed, are asphaltum, Burgundy pitch, resin, gum-copal, and gum-mastic; and, in a greater or less degree, all the resins and gum-resins will answer the purpose. Common resin has been most generally used, and answers tolerably well; though gum-copal makes a grain that resists the aquafortis better. The substance intended to be used for the grain must now be distributed over the plate as equally as possible; and different methods of performing this essential part of the operation have been used by different engravers, and at different times. The most usual way is to tie up some of the powder in a piece of muslin, and to strike it against a piece of stick held at a considerable height above the plate. By this, the powder that issues falls gently, and settles equally over the plate. Every one must have observed how uniformly hair-powder settles upon the furniture after the operations of the hair-dresser: this may afford a hint towards the best mode of performing this part of the process. The powder must fall upon it from a considerable height, and there must be a sufficiently large cloud of dust formed. The plate, being covered equally over with the dust or powder, the operator is next to proceed to fix it upon the plate,

by

to melt the particles. This may
der the plate lighted pieces of
l moving them about till every
ed. This will be known by its
ll turn brownish. It must now
it may be examined with a mag-
particles appear to be uniformly
e next part of the process.
g to be engraved must now be
of it as are perfectly white are to
sponding parts of the plate must
as it is called, with turpentine,
rnish, diluted with turpentine to
rk freely with the pencil, and
give it colour; for, if transpa-
ncil would not be so distinctly
plate must also be covered with
ng out is sufficiently dry, a bor-
ound the plate in the same man-
aquafortis, properly diluted with
s called biting in; and it is that
is most uncertain, and which
of experience. When the aqua-
at the plate, when printed, would
n the drawing, it is poured off,
water, and dried. When it is
are stopped out, and the aqua-
and this is repeated as often as
ed in the plate.
are etched entirely by this me-
biting in alternately, yet it may
general it would be very difficult
out all the finishing touches, as
nd many other objects, which
xecute with the necessary degree

fficulty, another very ingenious
, by which the touches are laid
ease and expedition as they are
Fine washed whiting is mixed
r, and diluted with water in the
, and this is laid on the plate
round, in the same manner and
on the drawing. When this is
ished over with a weak and thin
altum, or mastic, and then suf-
fered

fered to dry, when the aquafortis is poured on. The varnish will immediately break up in the parts where the treacle mixture was laid, and expose all those places to the action of the acid, while the rest of the plate remains secure. The effect of this will be, that all the touches, or places where the treacle was used, will be bit in deeper than the rest, and will have all the precision of touches in Indian ink.

" After the plate is completely bit in, the bordering wax is taken off by heating the plate a little with a lighted piece of paper; and it is then cleared from the ground and varnish by oil of turpentine, and wiped clean with a rag and a little fine whiting, and then it is ready for the printer.

" The principal disadvantages of this method of aquatinting are, that it is extremely difficult to produce the required degree of coarseness or fineness in the grain, and that plates so engraved do not print many impressions without wearing out. It is therefore now very seldom used, though it is occasionally of service.

" We next proceed to describe the second method of producing the aquatint ground, which is generally adopted. Some resinous substance is dissolved in spirits of wine, as for instance common resin, Burgundy pitch, or mastic, and this solution is poured all over the plate, which is then held in a slanting direction till all the superfluous fluid drains off, and it is then laid down to dry, which it does in a few minutes. If the plate be then examined with the magnifier, it will be found that the spirit in evaporating has left the resin in a granulated state; or rather, that the latter has cracked in every possible direction, still adhering firmly to the copper. A grain is thus produced with the greatest ease, which is extremely regular and beautiful, and much superior for most purposes to that produced by the other method. After the grain is formed, every part of the process is conducted in the same manner as above described.

" Having thus given a general idea of the art, we shall mention some particulars necessary to be attended to, in order to ensure success in the operatioh. The spirits of wine must be rectified, and of the best quality: what is sold in the shops contains camphor, which would entirely spoil the grain.

" Resin, Burgundy pitch, and gum-mastic, when dissolved in spirits of wine, produce grains of a different appearance and figure, and are sometimes used separately and sometimes mixed in different proportions, according to the ing one substance and some an-

coarse or fine grain, it is neces-
naller quantity of resin; and to
ortions, several spare pieces of
, on which the liquid may be
nined before it is applied to the

nade, it must stand still and un-
till all the impurities of the resin
n, and the fluid is perfectly pel-
f freeing it from those impurities
r. Straining it through linen or
which are ruinous to the grain.
the liquid is poured on the plate
free from dust, which, whenever
wet, causes the grain to form a
ossible to remove without laying

viously cleaned, with the greatest
nd whiting, as the smallest stain
luces a streak or blemish in the

e absolutely necessary to produce
and, after every thing that can be
ced artists, still there is much un-
They are sometimes obliged to
mes before they procure one suf-
ne proportions of materials do not
effect, as it depends in some de-
and it is even materially affected
ficulties are not to be surmounted
erience; and those who are daily
he art are frequently liable to the
ents. Indeed it is much to be
and useful a process should be so

o hold the plate in a slanting di-
off the superfluous fluid, there
body of the liquid at the bottom
e. On this account, a grain laid
ser at that side of the plate that
e most usual way is, to keep the
ground, being generally the part
ws. In large landscapes, some-
times

times various parts are laid with different grains, according to the nature of the subject.

"The finer the grain is, the more nearly does the impression resemble Indian ink, and the fitter it is for imitating drawings. But very fine grains have several disadvantages: for they are apt to come off before the aquafortis has lain on long enough to produce the desired depth; and as the plate is not corroded so deep, it sooner wears out in printing: whereas coarser grains are firmer, the acid goes deeper, and the plate will throw off a great many more impressions. The reason of all this is evident, when it is considered, that in the fine grains the particles are small and near to each other, and consequently the aquafortis, which acts laterally as well as downwards, soon undermines the particles and causes them to come off. If left too long on the plate, the acid would eat away the grain entirely.

"On these accounts, therefore, the moderately coarse grains are more sought after, and answer better the purpose of the publisher, than the fine grains which were formerly in use.

"Although there are considerable difficulties in laying properly the aquatint grain, yet the corroding the copper, or biting in, so as to produce exactly the tint required, is still more precarious and uncertain. All engravers allow that no positive rules can be laid down by which the success of the process can be secured; nothing but a great deal of experience and attentive observation can enable the artist to do it with any degree of certainty.

"There are some hints, however, which may be of considerable importance to the person who wishes to attain the practice of this art.

"It is evident, that the longer the acid remains on the copper, the deeper it bites, and consequently the darker will be the shade in the impression. It may be of some use, therefore, to have several bits of copper laid with aquatint ground of the same kind that is to be used in the plate, and to let the aquafortis remain for different lengths of time on each; and then to examine the tints produced in one, two, three, four minutes, or longer. Observations of this kind frequently repeated, and with different degrees of strength of the acid, will at length assist the judgment in guessing at the tint which is produced in the plate. A magnifier is also useful to examine the grain, and to observe the depth to which it is bit. It must be observed that no proof of the plate can be obtained till the whole process is finished.

"If any part appears to have been bit too dark, it must

eel burnisher; and this requires
agement, not to make the shade
nd durability of the grain is al-
it, so that it should be avoided

not dark enough must have a
and be stopped round with var-
the aquafortis. This is called
uliar care and attention. The
ned out with turpentine before
should be pretty coarse, other-
heights only, as is necessary in
rain. If the new grain is dif-
vill not be so clear, nor so firm,

general account of the process
and we believe that no material
tted that can be communicated
on. But after all, it must be
ections whatever can enable a
uccess depends upon so many
rcumstances apparently trifling,
ts it must not be surprised if he
is a species of engraving simple
ng goes on well; but it is very
hich are made are rectified with

hiefly for imitations of sketches,
t subjects; but does not appear
duce prints from finished pic-
of that accuracy in the balance
urpose. Nor does it appear to
it does not throw off a sufficient
is therefore not to be put into
modes of engraving. If con-
hich it is calculated, it must be
eful, as it is expeditious, and
less difficulty than any other
en this circumstance is a source
the production of a multitude
effect than that of vitiating the

d, the artists experience much
ntity of fumes liberated by the
copper, which, when the plate
emedy this inconvenience, the
following

following arrangement, which we think well calculated to answer the purpose, has been suggested to us by Mr. Cornelius Varley, a young artist who distinguishes himself no less by his mechanical abilities than by the exquisite productions of his pencil in water colours:—Get a frame made of common deal or any kind of wood, three or four inches deep, covered with a plate of glass, and open at one side; and let the side opposite to this have a round opening communicating, by means of common iron pipe, with the ash-pit of any little stove or other fire-place, shut up from all other access of air but what must pass through the pipe. It is obvious that any fumes rising from a copper-plate laid under such a frame will be carried backward into the iron pipe by the current of air required to maintain combustion in the stove, and will by this means be carried up the chimney in place of being allowed to fly about in the apartment. The pipe may be very conveniently used by carrying it down through the table to the floor, and so along to the place where the chimney may chance to stand; and when the frame is not wanted, the pipe at one of the joinings (as at A, Plate V.) may be made to answer the purpose of a hinge by which to turn up the frame against the wall, as marked by the dotted lines, where it may be secured, while out of use, by a button or any other contrivance.

XXIX. *On pure Nickel, discovered to be a noble Metal; on its Preparation and Properties. By* J. B. Richter*.

When sulphate of ammonia and nickel are repeatedly crystallized, the whole of the cobalt, excepting a very minute quantity, is separated; but there still remains some copper mixed with the salt. I some time ago announced, that this metal may be separated from the nickel by subliming the latter with sal ammoniac, but I had not then ever obtained pure nickel. With the compound salt of nickel and ammonia there still remains a little arsenic. Iron also may be in it, if we have been a little too sparing in the addition of nitric acid to the sulphuric solution of cobalt containing nickel.

I attempted to separate these extraneous metals in the humid way, but without complete success. By means of carbonate of potash, I decomposed the triple ammoniacal

---

* From *Van Mons's Journal de Chimie,* vol. vi.

on, and as much so as possible
ecipitate was still visibly of a
ving edulcorated it and heated it
s carbonic acid, and changed its
hich, however, inclined evidently
ployed in washing it, which had
evaporated to dryness, and the
ed red hot, was washed again.
, which did not lose its colour
iefly of arseniate of nickel.
ns were separately mixed with
in a cupel with a little porcelain
f a potter's furnace for eighteen
ed a few blows of a hammer
t of the latter residuum was
gile than that of the former,
oached that of steel, and was
ere both attacked with avidity
re attracted by the magnet, but

obable from some of its effects
el was a noble metal, I dissolved
whole quantity reduced, which
s, and evaporated the solution
d water on the saline mass, and
as formed; but a greenish white
ch I easily detected the presence
acid.
tained a considerable portion of
as precipitated by carbonate of
, the colour of which was still
green as that of carbonate of
and exposed to a white heat.
n colour to a deep green inclining
stronger heat the mass assumed
ame time appeared to coagulate.
ns of reduced metal in it, that
could not, however, accomplish
surmounted with a cupellating
a long chimney. In conse-
veral portions, which I exposed
t heat of a potter's furnace, in
t refractory clay are frequently

placed where the porcelain re-
quires

quires the longest time to bake it, the matter underwent no change but that of being coagulated. In the other crucibles the matter had fused, but not so as to be completely liquid: the crucibles themselves had also partly experienced the same effect: here and there in the melted mass metallic globules were found, the largest of which were the size of a small nut, and the least that of a cherry-stone. Their brilliancy was a mean between that of silver and that of English tin. The scoriæ were greenish brown, mixed with an amethyst colour, and in some places a deep blue entirely like fused oxide of cobalt. The brown colour arose from the oxide of copper, which was completely vitrified, and the blue from that of cobalt. The green, on the contrary, proceeded from arseniate of nickel, which, as experience has taught me, strongly resists fusion unless some combustible substance be added to it.

To my great satisfaction on, trying the metallic globules with a hammer, I found that they possessed a considerable degree of malleability.

As I found it impossible to separate with a hammer the scoriæ from the little globules to which they adhered, I collected them together by trituration and decantation, and exposed them to fusion afresh. It was again complete only in the places of the furnace most heated.

These experiments having convinced me that nickel is reducible in the fire, without the addition of any combustible matter, I attempted to reduce some oxide of this metal, obtained by the decomposition of the triple ammoniacal salt of nickel, which during an uninterrupted labour of eighteen months I had procured in a very large quantity. On this occasion the same phænomena occurred as in the preceding reductions.

The melting I repeated till the metal had undergone a complete fusion, and was found collected together in a button at the bottom of the crucible. In one crucible which had been exposed to the strongest heat, I obtained a button that weighed an ounce and a half. I was less successful in my fusion when I mixed the oxide of nickel with porcelain glaze, or when I simply covered it with this glaze; so that I was convinced the best process was to reduce the oxide of nickel directly. After much time and patience, I succeeded in obtaining several ounces of nickel, which I must consider as absolutely pure: and I shall now proceed to describe the principal characters that I have perceived in it in this state.— To begin with the external characters.

is a mean between silver and tin.
her by atmospheric air, or the
words, it is not susceptible of

e, that it may not only be forged
hammered on the anvil while
This character removes nickel
als to that of perfect metals.
vity is pretty considerable: from
my hydrometer, cast nickel
ickel 8·666.
nsiderable, if we may judge from
e of cast nickel, weighing five
flattened, but not without crack-
uare inches Rhynland measure,
f an inch for its thickness. It
to a wire of the same tenuity.
to fusion is considerable, and
, that of manganese. The reader,
it, may have observed how
is head any thing decisive.
ently high temperature, the pure
e without the addition of any
reat resistance to fusion is the
n presents so many difficulties.
is perceptible on keeping this
cence : it is merely tarnished a
d, or silver. Nickel, therefore,
perfect metals merely, but to

n nickel an action not only
inferior to that on iron. It be-
res polarity, by the touch, and
with a hammer, or filing it,
le for producing this effect. I
ty by presenting to the magnet
when, notwithstanding it was
red more feebly to the magnet
ed; but on my presenting its
net, it adhered to it with great
by either side not only iron
half an inch square, which it
smooth table.
roperty of becoming magnetic,
g alloyed with copper. Arsenic,
s it. I had frequent opportu-
nities

nities of making this observation in the course of my experiments. Some nickel, from which I had separated the iron* and the arsenic in the humid way, and which I had afterwards reduced with the addition of a combustible substance, was malleable, and attracted the magnet, though not so forcibly as pure nickel. The same metal, purified with less care, was less malleable, and proportionally less attractable by the magnet. Repeated exposure of the metal to the most powerful heat of a porcelain furnace did not in the least restore to it this property.—Some experiments, which I shall hereafter relate, have convinced me, that copper cannot be entirely separated from nickel in the humid way, and that the only means of separating them is to reduce the cupreous oxide of nickel by fire.

The sulphuric and muriatic acids exercise but little action on nickel. Even its oxide by air does not dissolve in the latter without the assistance of a strong ebullition. The most appropriate solvents of nickel are the nitric and nitro-muriatic acids. I have already mentioned, that impure nickel, particularly the cupreous, is attacked by the nitric acid with heat and vivacity. The action of the same acid on pure nickel is a little different, and particularly on the hammered metal. I have poured nitric acid on nickel both in buttons and laminated, expecting a very active solution; but it has proceeded slowly, and I have even been obliged to have recourse to the heat of a spirit lamp to accelerate it. The dissolution, however, having appeared to cease, I decanted the liquid and poured on the residuum a fresh quantity of acid of the same strength as the preceding, when on a sudden such a brisk action came on, accompanied with the evolution of heat†, that I could not remove the capsule to the fire-place quickly enough.

I shall now proceed to consider some of the characters of pure nickel in the state of oxidation.

The nitric solution of pure nickel has a beautiful grass-green colour. Carbonate of potash separates from it a pale apple-green precipitate. This precipitate well washed and dried is very light. A thousand parts of metallic nickel reduced to this precipitate weigh 2·927 parts.

---

* The separation of the iron succeeds best by a rapid evaporation of the nitric solution of the ferruginous nickel, by which the iron is precipitated in the form of an insoluble oxide. At the same time a little arsenic is separated in union with the iron. It is preferable, however, to separate the arsenic first, which is effected by the help of a nitric solution of lead. The lead is afterwards to be precipitated by a solution of sulphate of potash.

† From this it is difficult to believe that nickel, under favourable circumstances, would not become oxided by the combined influence of air and fire.—*Van. Mons.*

sed to a white heat it becomes of
clining to green, and weighing
g the fire, the mass approaches
more, and becomes magnetic.
speedily if the oxide be moist-

ded in excess to a nitric solution
rmed, resembling in colour am-
so deep. This colour sometimes
rs to an amethyst-red, and to a
onverted into an apple-green on
l again to a blue and violet on
however, we add to the solution
r, so as to produce no perceptible
precipitate formed by ammonia
ge, and the red colour of the
ears on the addition of a little
nce it follows, that every pre-
ia which retains its blue colour,
it.

Vegetable Substance discovered
ROSE*.

urs, a decoction of the root of
) deposits a white powder, ap-
h, but differing from it both in its
of action with other substances.
uble, generally, in cold water:--
vhite milky liquor is formed,
y white powder, and leaves the
colourless.

ssolves very well. On boiling
ler with four parts of water, a
ed which passes through filter-
on cooling, acquires a mucila-
dull colour. In the course of
eposits the greater part of the
orm of a compact white powder.
lissolved in four parts of water,
enacious consistence, and froths
of the powder from the elecam-

ite powder mixed with an equal
t clear, but in a little time the
n of a tumid white sediment,
nsparent. A solution of gum-

---

n's Journal, vol. iii.

arabic on the addition of alcohol becomes immediately milky, and long retains this appearance, no kind of powder separating even in several days.

4. The white powder, when thrown on burning coals, melts like sugar and evaporates, diffusing a white, thick, pungent smoke, with a smell of burnt sugar. After this combustion a light residuum only remains, which runs into the coal. Starch emits a similar smoke, but does not melt, and leaves a coally residuum much greater in quantity. Gum-arabic under the same circumstances gives out scarcely any smoke.

When heated over charcoal in an iron spoon, the powder first melts and emits the smoke above described; but as soon as the spoon becomes red hot, it burns with a vivid light flame, and leaves a very trifling coally residuum. Starch under the same circumstances does not melt, is much longer before it burns, and leaves a considerable residuum of coally matter. Gum-arabic only sparkles, does not take fire, and leaves a great deal of coal, which is readily convertible into grayish ashes.

5. From this powder, by dry distillation, we obtain a brown empyreumatic acid, having the smell of pyroxalic acid, but none of empyreumatic oil.

6. Nitric acid transforms the powder into malic and oxalic acids, without producing a single atom of saccholactic acid, which gum-arabic furnishes very abundantly when treated in the same manner; nor does it yield any of the fatty matter generated by the action of nitric acid on starch.

It follows from all these phænomena, that this farinaceous powder extracted from elecampane root is neither starch nor gum, but a peculiar vegetable substance holding a middle rank between the two. It is probable that it exists in many other vegetables, and that several products hitherto considered as starch are of the same nature as this farina.

XXXI. *Facts relative to the Torpid State of the North-American Alligator. By* BENJAMIN SMITH BARTON, M.D*.

It has not, I think, been remarked by the generality of the writers on natural history, that the North American Alligator passes during the prevalence of cold weather into the torpid state. This, however, is unquestionably the case in some parts of the continent.

---

* From *The Philadelphia Medical and Physical Journal*, edited by Dr. Barton.

Mr.

riter, after telling us that these
e Red River, one of the western
i, says "they are torpid during
he mud with their mouths open,
s into a funnel, and neither ad-
dians then get upon their backs,
their heads with hatchets, and
or them*."

r of the work, observes in the
e circumstance of the alligator's
is quite new, and very remark-
It seems (he adds) almost all the
phibia, by Dr. Linnæus, when
torpid during winter.

ity of Mr. Bossu, I may here
t, which was communicated to
a Mr. Graham, at that time a
medicine in the University of

reviously swallowed a number of
ole, where he remains in a torpid
f the winter. If killed at this
d highly polished by their tritu-
in the animal's stomach, as I
from men of undoubted veracity,
in the fact. Indeed this is so
which these creatures abound,
alligator's stomach is proverbial
ho deride its insipidity in the
igh, I presume, this it does in-
ose unaccounted for by natu-
, is beyond the limits of human

Graham, relates to the alligator
parts of the United States this
y another gentleman I have been
ts which the alligators swallow
ery abundant in turpentine. I
my friend Mr. William Bartram,
at which was taken out of the
d that it was worn quite round.
he alligator is not seen to the
They are very common at Cape-
e twelve feet in length has been

---

orth America formerly called Louisiana.
London 1771.

seen at this place. On the Atlantic side of the United States I am not able to trace them further than the "Alligator Dismal Swamp", which is between Edenton and Newbern in North-Carolina. The mouth of the Red River in latitude 31°.

Within the tract of country just mentioned, the alligator, obeying the impulse of the climate, passes into the torpid state. In North-Carolina this takes place about the middle of November, sooner or later according to the state of the season. Whether the animal becomes torpid in more southern parts of the continent I have not been able to learn. On the river St. John, in East-Florida, they have been seen awake even in the middle of winter, but it was remarked that they seemed dull and stupid. It has also been observed, that they are accustomed to frequent the warm springs which are so abundant in this part of the continent; and that they are fond of lying in these springs. Perhaps the heat of these springs may be sufficient to prevent them from becoming torpid. But it must be observed, that a deficiency of heat is not the only cause of the torpid condition of animals.

It may not perhaps be an easy task to assign a satisfactory cause for the singular instinctive appetite which leads the alligator, before going into the torpid state, to swallow pine-knots and other somewhat similar substances. But I apprehend that these substances, when taken in by the animal, act in some measure by keeping up a certain degree of action in its stomach, and consequently in every part of the system, and thereby prevents the death of the animal, which might otherwise be destroyed by the long continued application of cold. Some facts mentioned by Dr. Pallas, though they respect a very different family of animals, render this conjecture not a little plausible*.

This subject is worthy of more attention. In particular, it will be well to inquire, whether the alligator does swallow pine-knots, stones, &c., in those parts of America in which it does not pass into the torpid state.

XXXII. *Process for obtaining pure Cobalt. By M.* TROMSDORFF †.

MIX intimately four parts of zaffer, well pulverized, with one part of nitrate of potash and a half part of charcoal in

---

[*] Historia Glirium, &c.

[†] Extracted from the *Journal de Chimie* of M. Gehlen by M. Darcet, and inserted in the *Annales de Chimie*, No. 162.

, by little and little, into a
e operation three times, adding
v quantities of potash and of

hese detonations ought after-
art of black flux, and exposed
le, to a red heat. Leave the
etallic cobalt and pulverize it,
nate with the same precautions

e cobalt oxidates itself very
senic combines with the pot-
e pulverized mass, and by fil-
e of potash, which has been
esidue which contains the co-

itric acid, which dissolves the
e iron, which is carried to its

ryness; redissolve the residue
the liquor to separate the last
ich might have escaped at the

ecompose the nitrate of cobalt
ecipitate, and to operate the
eat.

---

alysing Stones containing fixed
Boracic Acid. *By* HUMPHRY
essor of Chemistry in the Royal

cid a very useful substance for
ts of stones containing a fixed

nt simple earths is considerable
the compounds that it forms
osed by the mineral acids dis-
n this circumstance that the
d.
ple.

---

f the Royal Society for 1805.

100 grains of the stone to be examined in very fine powder, must be fused for about half an hour, at a strong red heat, in a crucible of platina or silver, with 200 grains of boracic acid.

An ounce and half of nitric acid, diluted with seven or eight times its quantity of water, must be digested upon the fused mass till the whole is decomposed.

The fluid must be evaporated till its quantity is reduced to an ounce and half or two ounces.

If the stone contain silex, this earth will be separated in the process of solution and evaporation; and it must be collected upon a filter, and washed with distilled water till the boracic acid and all the saline matter is separated from it.

The fluid, mixed with the water that has passed through the filter, must be evaporated, till it is reduced to a convenient quantity, such as that of half a pint; when it must be saturated with carbonate of ammonia, and boiled with an excess of this salt, till all the materials that it contains, capable of being precipitated, have fallen to the bottom of the vessel.

The solution must then be separated by the filter, and the earths and metallic oxides retained.

It must be mixed with nitric acid till it tastes strongly sour, and evaporated till the boracic acid appears free.

The fluid must be passed through the filter, and subjected to evaporation till it becomes dry; when, by exposure to a heat equal to 450° Fahrenheit, the nitrate of ammonia will be decomposed, and the nitrate of potash or soda will remain in the vessel.

It will be unnecessary for me to describe minutely the method of obtaining the remaining earths and metallic oxides free from each other, as I have used the common processes. I have separated the alumine by solution of potash, the lime by sulphuric acid, the oxide of iron by succinate of ammonia, the manganese by hydrosulphuret of potash, and the magnesia by pure soda.

XXXIV. *Observations on the singular Figure of the Planet Saturn. By* William Herschel, *LL.D. F.R.S.*[*]

There is not perhaps another object in the heavens that presents us with such a variety of extraordinary phænomena as

---

[*] From the *Transactions of the Royal Society* for 1805.

gnificent globe, encompassed by
; attended by seven satellites;
belts; compressed at the poles;
ually eclipsing its ring and satel-
; the most distant of the rings
and the same taking place with
; all the parts of the system of
ig light to each other; the rings
e nights of the Saturnian; the
ning the dark parts of the rings;
throwing back the sun's beams
ey are deprived of them at the

a detail of circumstances like
ly any room for addition, and
ns will prove that there is a sin-
uishes the figure of Saturn from

oned on a former occasion, that
6 I perceived that the body of
nd; and when I found in the
ed at the poles at least as much
y diverted from a more critical
figure. Prepossessed with its
ured the equatorial and polar
and supposed there could be no
rk in the figure of the planet.
irregularity in other parts of the
ibed to the interference of the
plete view of its whole contour;
l have remained, had not a late
of my 10-feet telescope con-
ly with the greatest confidence
sentations of the most minute

s, in which the singular figure
ted, contain many remarks on
that may be seen when this
d with attention; and though
ecessary to my present subject,
hem, as they show the degree
of the action of the telescope,
osphere at the time of obser-

---

new 7-feet mirror of extraor-
dinary

dinary distinctness, I examined the planet Saturn. The ring reflects more light than the body, and with a power of 570 the colour of the body becomes yellowish, while that of the ring remains more white. This gives us an opportunity to distinguish the ring from the body, in that part where it crosses the disk, by means of the difference in the colour of the reflected light. I saw the quintuple belt, and the flattening of the body at the polar regions; I could also perceive the vacant space between the two rings.

The flattening of the polar regions is not in that gradual manner as with Jupiter, it seems not to begin till at a high latitude, and there to be more sudden than it is towards the poles of Jupiter. I have often made the same observation before, but do not remember to have recorded it any where.

April 18; 10-feet reflector, power 300. The air is very favourable, and I see the planet extremely well defined. The shadow of the ring is very black in its extent over the disk south of the ring, where I see it all the way with great distinctness.

The usual belts are on the body of Saturn; they cover a much larger zone than the belts on Jupiter generally take up, as may be seen in the figure I have given in Plate IX.; and also in a former representation of the same belts in 1794 *.

The figure of the body of Saturn, as I see it at present, is certainly different from the spheroidical figure of Jupiter. The curvature is greatest in a high latitude.

I took a measure of the situation of the four points of the greatest curvature, with my angular micrometer, and power 527. When the cross of the micrometer passed through all the four points, the angle which gives the double latitude of two of the points, one being north, the other south of the ring, or equator, was 93° 16′. The latitude therefore of the four points is 46° 38′; it is there the greatest curvature takes place. As neither of the cross wires can be in the parallel, it makes the measure so difficult to take, that very great accuracy cannot be expected.

The most northern belt comes up to the place where the ring of Saturn passes behind the body, but the belt is bent in a contrary direction, being concave to the north, on account of its crossing the body on the side turned towards us, and the north pole being in view.

There is a very dark, but narrow shadow of the body

---

* See Phil. Trans. for 1794, Table VI. page 32.

he ring, which as it were cuts

n the body, which I see south
roader on both sides near the

two rings is dark, like the va-
, but not black like the shadow

on the preceding side near the
her are north-preceding; the
ng.
lanet Saturn with a new 7-feet
which are very perfect. I saw
ed last night, except the satel-
heir situation; four of them
This telescope however is not

Saturn admits of no doubt:
n is once drawn to an object,
nt that would otherwise have

00. The night is beautifully
the meridian. The figure of
quare or rather parallelogram,
d off deeply, but not so much
I see it in perfection.
re last night on the preceding,
le, and are very bright.
sition of the four points of the
d it 91° 29′. This gives their
e this measure to be pretty ac-
thread to one of the lines, by
ng and south-following two
adjusted the other thread in
h-preceding and north-follow-

my 20-feet telescope to Saturn,
300, saw the planet perfectly
being remarkably clear. The
dy is quite black. All the other
t.
certainly not spheroidical, like
The curvature is less on the
han at the latitude of about 45
ameter is however considerably

In order to have the testimony of all my instruments, on the subject of the structure of the planet Saturn, I had prepared the 40-feet reflector for observing it in the meridian. I used a magnifying power of 360, and saw its form exactly as I had seen it in the 10- and 20-feet instruments. The planet is flattened at the poles, but the spheroid that would arise from this flattening is modified by some other cause, which I suppose to be the attraction of the ring. It resembles a parallelogram, one side whereof is the equatorial, the other the polar diameter, with the four corners rounded off so as to leave both the equatorial and polar regions flatter than they would be in a regular spheroidical figure.

The planet Jupiter being by this time got up to a considerable altitude, I viewed it alternately with Saturn in the 10-feet reflector, with a power of 500. The outlines of the figure of Saturn are as described in the observation of the 40-feet telescope; but those of Jupiter are such as to give a greater curvature both to the polar and equatorial regions than takes place at the poles or equator of Saturn which are comparatively much flatter.

May 12. I viewed Saturn and Jupiter alternately with my large 10-feet telescope of 24 inches aperture: and saw plainly that the former planet differs much in figure from the latter.

The temperature of the air is so changeable that no large mirror can act well.

May 13. 10-feet reflector, power 300. The shadows of the ring upon the body, and of the body upon the ring, are very black, and not of the dusky colour of the heavens about the planet, or of the space between the ring and planet, and between the two rings. The north-following part of the ring, close to the planet, is as it were cut off by the shadow of the body: and the shadow of the ring lies south of it, but close to the projection of the ring.

The planet is of the form described in the observation of the 40-feet telescope; I see it so distinctly that there can be no doubt of it. By the appearance I should think the points of the greatest curvature not to be so far north as 45 degrees.

The evening being very calm and clear, I took a measure of their situation, which gives the latitude of the greatest curvature 45° 21′. A second measure gives 45° 41′.

Jupiter being now at a considerable altitude, I have viewed it alternately with Saturn. The figure of the two planets is decidedly different. The flattening at the poles and on the

reater than it is on Jupiter, but
of from 40 to 48° on Jupiter is

observations many times, and
wo planets together, the more
tructure.
r. With a parallel thread mi-
ower of 400, I took two mea-
oints of greatest curvature. A
visions = 11″,98. After this,
the equatorial diameter, and a
sions = 11″,27; but the equa-
too small.
planet, I should suppose the
ture to be less than 45 degrees.
the difference in the three dia-
ich passes through the points
the largest; the equatorial the
is the smallest.
eing very favourable, I took
liameter between the points of
of which was 63,8 divisions
f the equatorial diameter gave

e that a more accurate measure
in which the greatest curvature
xed thread of the micrometer
f Saturn, which may be done
two following measures were
e more satisfactory than I had
the latitude of the south-pre-
ature 43° 26′; and the second
will be 43° 20′.
and Saturn alternately with a
00, that the convexity of the
deception, and found the form
in the manner that has been

rence very plainly; and even
visible to admit of no doubt.
figure of the planets perfectly
is enlarged, and the motion of
ed, we are more at liberty to

appearance of Saturn with a
I have taken, combined with
the

the proportion between the equatorial and polar diameters determined in the year 1789[*]; and found that, in order to be a perfect resemblance, my figure required some small reduction of the longest diameter, so as to bring it nearly to agree with the measures taken the 27th of May. When I had made the necessary alteration, my artificial Saturn was again compared with the telescopic representation of the planet, and I was then satisfied that it had all the correctness of which a judgment of the eye is capable. An exact copy of it is given in Plate VII. The dimensions of it in proportional parts are,

The diameter of the greatest curvature	36
The equatorial diameter	35
The polar diameter	32
Latitude of the longest diameter	43° 20′

The foregoing observations of the figure of the body of Saturn, will lead to some intricate researches, by which the quantity of matter in the ring, and its solidity, may be in some measure ascertained. They also afford a new instance of the effect of gravitation on the figure of planets; for in the case of Saturn, we shall have to consider the opposite influence of two centripetal and two centrifugal forces: the rotation of both the ring and planet having been ascertained in some of my former papers.

XXXV. *Experiments and Observations upon the Contraction of Water by Heat at low Temperatures. By* THOMAS CHARLES HOPE, *M.D. F.R.S. Edin., Professor of Chemistry in the University of Edinburgh*[*].

To the general law, that bodies are expanded by heat, and contracted by cold, water at the point of congelation, and for some degrees of temperature above it, seems to afford a very singular and curious exception.

The circumstances of this remarkable anomaly have been for some time believed to be the following:

When heat is applied to water ice-cold, or at a temperature not far distant, it causes a diminution in the bulk of the fluid. The water contracts, and continues to contract, with the augmentation of temperature, till it reaches the

---

[*] See Phil. Trans for 1790, p. 17.

[†] From the *Transactions of the Royal Society of Edinburgh*, part ii. of vol. v.

een this point and the 42d or
perceptible change; but when
ntioned degree it begins to ex-
lume with every subsequent rise

f caloric, the peculiarity in the
ly appears. Warm water, as it
dies do, till it arrives at the tem-
hen suffers a loss of two degrees
nsity. But when further cooled,
tinues to dilate, as the tempera-
tually commences, whether this
reaches the 32d degree, or after
r of degrees below it.
y of water to be established, it
ry odd circumstance, that heat
n in this fluid, while it causes
and no less strange, that within
should contract, and in another
tance. Before a deviation from
received as matter of fact, the
t to be clear and indisputable.
published, from which this sin-
have all of them been performed
struments shaped like a thermo-
g of a ball with a slender stem;
ctive effects of heat and cold have
ent or descent of the fluid in the

has been objected, that the di-
the instrument undergo so much
temperature, that it is difficult,
mine how much of the apparent
ted to such changes, and that it
whole of it may be ascribed to

, which I have now the honour to
prove, by a set of experiments,
ogether different, that the com-
n truth, and that water presents
unaccountable anomaly which I

re detailing my experiments, to
ose observations which led to the
which in succession have extended
ell as of those observations which

have at different periods been offered to discredit, and to bring it into doubt.

The first observation relative to this subject was made by Dr. Croune, towards the close of the 17th century, while engaged in investigating the phænomena of the great and forcible, though familiar, expansion which happens to water at the instant of freezing; a matter which occupied, in a considerable degree, the attention of his fellow-members of the Royal Society of London in the earlier years of that institution.

I shall relate, in his own words, his first observation:—"I filled a strong bolt-head about half way up the stem with water, a day or two before the great frost went off, marking the place where the water stood; and placing it in the snow on my leads, while I went to put some salt to the snow, I found it above the mark so soon, that I thought the mark had slipt down, which I presently raised to the water, and as soon as ever I mixed the salt with the snow, the water rose very fast, about one-half inch above it. I took up then the glass, and found the water all fluid still: it was again set down in the salt and snow; but when I came, about an hour after, to view it, the ball was broken, and the water turned to hard ice, both in the ball and stem *."

From this experiment Dr. Croune drew the conclusion, that water, when subjected to cold, actually began to expand before it began to freeze. On announcing it, however, to the Royal Society, on the 6th of February 1683, Dr. Hooke immediately expressed strong doubts, and ascribed the ascent of the water in the neck of the vessel to the shrinking of the glass occasioned by the cold.

To obviate this objection, and to preclude, as far as was possible, the influence of the change of capacity in the apparatus from an alteration of its temperature, a bolt-head was immersed in a mixture of salt and snow, and into it, when cooled, was poured, to a certain height, water previously brought to near the freezing point. The water began instantly to rise as before, and when it had ascended about one-fourth of an inch in the stem, the vessel was taken out, the whole water remaining fluid.

These experiments, supported by others of a similar nature, communicated by Dr. Slare to the society on the 20th of the same month, appear to have satisfied its members, in general, of this fact, that water, when on the point of congealing,

---

* Birch's History of the Royal Society, vol. iv. p. 263.

l fluid, is actually somewhat di-
arkable expansion which accom-
ce.
ontinued unshaken, and retained
d.
as now stated, must have ap-
e excited particular attention, nor
nute examination; and, indeed,
ot lose sight of it, yet for near a
l it more carefully. Mairan, in
, and Du Crest in his Disserta-
757, appear to be well aware of
t it is to M. de Luc that we owe
ng and more interesting circum-
&c. 1772.)
ation to the examination and im-
neter, he was naturally led to the
l in ascertaining the phænomena
action of different fluids by heat

periments thermometer glasses;
or near the term of liquefaction,
l appeared to him to suffer a di-
increase of temperature till it
this point its volume increased
it ascended in the tube. This
owed to cool, seemed to him to
way, till its temperature sunk to
l increase in volume as the tem-
point.
e thence inferred, is at its maxi-
s with equal certainty whether
or depressed.
that very nearly the same altera-
ned in water of temperature 41°,
n number of degrees of tempera-
increase or of diminution; and
sity of water at temperature 50°,
the same.
ot conceive that the constitution
loric, undergoes a change at the
that short of this degree caloric
n, and beyond it expansion. He
mperatures tends to produce two,
on this fluid, the one expansion,

In low temperatures, the contractive effects surpass the expansive, and contraction is the consequence: in temperatures beyond 41°, the expansive predominate, and the visible expansion is the excess of the expansive operation over the contractive.

In 1788 sir Charles Blagden added the curious observations, that water, which by slow and undisturbed refrigeration permits its temperature to fall many degrees below its freezing point, perseveres in expanding gradually as the temperature declines; and that water, having some muriate of soda, or sea salt, dissolved in it, begins to expand about the same number of degrees above its own term of congelation that the expansion of pure water precedes its freezing, that is, between eight and nine degrees. More lately (Philosophical Transactions 1801), he, or rather Mr. Gilpin by his direction, endeavoured to ascertain, by the balance and weighing-bottle, the amount of this change of density caused by a few degrees of temperature.

Every one must be familiar with the use which count Rumford has made of this peculiarity in the constitution of water, in explaining many curious appearances that presented themselves in his experiments upon the conducting power of fluids, and in accounting for certain remarkable natural occurrences. The count, with his usual ingenuity, has endeavoured to point out the important purposes which this peculiarity serves in the œconomy of nature, and to assign the final cause of so remarkable an exception from a general law.

In recording the observations and opinions that have been published concerning this point, I might now, in order, notice those of Mr. Dalton, of Manchester, related in the fifth volume of the Manchester Memoirs, which tended to confirm and enlarge our knowledge of it. But as Mr. Dalton himself has called in question the accuracy of the conclusions which had been drawn from his experiments, and from those of preceding observers, I shall only remark, that they are of the same nature, and nearly to the same purport, as those of M. de Luc.

It was in consequence of a communication with which Mr. Dalton favoured me, three months ago, that my attention was directed to this subject. He informed me, that after a long train of experiments he was led to believe that he, and his predecessors in the same field of investigation, had fallen into a mistake with regard to the contraction of water by heat, and its expansion by cold, in consequence of overlooking or underrating the effect which the change

mometer-shaped apparatus em-
ne apparent volume of the fluid.
ns, that on subjecting water to
ature, in instruments made of
d the point of greatest density
temperature in each.
a ball of earthen ware, it was at
t the 42d; of brass at the 46th;
nd as water could not follow a
the nature of the substance of
ed that the appearance of ano-
d entirely in the containing ves-
fluid in the stem to fall or rise
are greater or less than those of

tant experiments has, ere now,
tion in the Journals of the Royal

hat Dr. Hooke endeavoured to
r the original experiment of Dr.
apparently gathers much force
Mr. Dalton.
state, that M. de Luc was per-
n in the dimensions of his glass
change too trifling to have any

greater attention to the circum-
attempted to appreciate what
de for the change of capacity in
changes of volume.
at the whole amount of the ap-
mall, and that the expansibility
y ascertained, and is variable by
roportions of its heterogeneous
nowledged that precision in such
ly be attained, and can scarcely
ccount, all the experiments al-
the explanation of Dr. Hooke,
to the objection which he had
experiments of Mr. Dalton, in
that explanation, created consi-
he existence of the peculiarity of
ility of which circumstance, all
every argument *à priori*, strongly

uncertainty, and considering it
as

as a point of much curiosity and interest, I have endeavoured to investigate the subject by experiments conducted in a totally different manner, equally calculated to exhibit the singular truth, but free from the objections to which the others are liable. In them, it was my object to provide, that neither the changes of the actual volume of the water, nor the alterations in the dimensions of the instrument, should have any influence whatever.

I have already taken occasion to state, that the purpose of this paper is to prove, by experiments on the principle now mentioned, that in the constitution of water there really exists the singularity often noticed.

I shall first state the plan of the experiments, and then detail the particulars of the most remarkable of them.

When any body is dilated, whether by heat or cold, it necessarily becomes less dense, or specifically lighter; and the opposite effects result from contraction. This is the circumstance, as every one knows, which causes various movements among the particles of fluids, when any inequality of temperature prevails in the mass; hence these particles are little acquainted with a state of rest.

If a partial application or subtraction of heat produce an inequality of density in a mass of fluid, the lighter parts rise to the surface, or the denser fall to the bottom.

It readily occurred, that I might avail myself of these movements, and upon statical principles determine the question in dispute.

I had only to examine attentively water, as it was heated or cooled in a jar, and to observe, by means of thermometers, what situation the warmer, and what the cooler parts of this fluid affected.

If I should find that ice-cold water, in acquiring temperature, showed, in its whole progress, the warmer parts near the top, it would indicate that water follows the usual law, and is expanded like other bodies by heat.

Or if I should observe that warm water, in cooling to the freezing point, had the coldest portion uniformly at the bottom, the same conclusion would follow; while a different inference, and the existence of the supposed anomaly, would be deducible should the event prove different. The only circumstance I can figure to myself as tending in any measure to render this mode of examining the point doubtful, is, that water near its congealing point may have so little change of density occasioned by a small variation of temperature, that its particles may be prevented by their inertia, or by the tenacity of the circumfluent mass, from hich their specific gravity would

, very clear, from the circumstances I shall immediately detail, that no nd precision of the experiments ce.

me to relate all the experiments I rict myself to the detail of six, n the modes of procedure, and iking results.

periment I.

r of glass 8¼ inches deep, and 4¼ f temperature 32°, and placed it considerable thickness of matter of conducting heat. I suspended fluid, nearly in the axis of the jar, alf an inch from the bottom, the e below the surface. The jar was of the room, the temperature of 2°.

enced at noon:

	Top Thermom.		Bottom do.
	32°	-	32°
-	33+	-	34+
-	35·5	-	37
-	37	-	38+
-	38	-	38+
ninutes	42	-	38·25
———	44	-	40
———	46+	-	41+
ninutes	48	-	42·5
———	50	-	44
———	50·5	-	45
-	54	-	49

tions of the thermometers, from n, that when heat flows on all r into a column of ice-cold water, e fluid actually descend, and take of the vessel.

proclaims an increased density, water is contracted by heat. As id at the bottom exhibits a temrse is retarded and soon stopped, mperature beyond 40° is totally ass attains this degree, the experiment

riment equally shows, that the warmer fluid ascends and occupies the summit, by its route announcing its diminished density, and proving that water is now expanded by heat.

Experiment II.

I filled the same jar with water of temperature 53°; and that I might observe the phænomena of cooling, I placed it in the axis of a much larger cylindrical vessel, nearly full of water, of temperature 41°, and, by an earthen-ware support, raised it about three inches from the bottom, taking care that the water should be on the same level in both vessels. As soon as I had adjusted the two thermometers, as in the former experiment, I observed that the top of the fluid was still at 53°, but the bottom had fallen to 49°.

	Top.		Bottom.
In 9 minutes	52°	-	45
— 15 ———	52	-	44

Now, to accelerate the cooling, I withdrew by a syphon the water from the large cylinder, and supplied its place by ice-cold water, mixed with fragments of ice, which by repeated cautious agitation was kept uniformly at the temperature of 32°.

In 23 minutes	48°	-	42+
— 38 ———	44	-	40
— 43 ———	42	-	40
— 46 ———	40	-	40
— 52 ———	36	-	40
— 58 ———	35—	-	39
— 65 ———	34	-	37
— 75 ———	34	-	36
—103 ———	34	-	34

This experiment is the counterpart of the foregoing, and from the testimony of the same instruments, it appears, that when a cylinder of water of 53° is cooled by circumfluent iced fluid, the colder part of the water takes possession of the bottom of the vessel, so as to establish a difference of temperature from the surface, amounting sometimes to 8°. And that as soon as the fluid at the bottom arrives at the 40th degree, the temperature of the fluid in that situation is stationary till the surface reaches the same point.

During the subsequent refrigeration, the progress of the cooling undergoes a total change. The thermometers tell that the colder fluid rises to the surface; so that the top

soon by 4°, and attains the
ery long before the other falls

hink, lead to the conclusion,
vater at 53° is contracted and
, and that this continues to
o the temperature of 40°, at
ect is produced; for now the
specifically lighter, or is ex-

mer experiment, the complete
ch the warmer and colder parts
progress both of the heating
ernal circumstance of the pro-
particularly worthy of remark.

ment III.

ches deep, and 4·5 in diameter,
neck and tubulature very near
a cylindrical bason of tinned
0 inches in diameter, with a
f the bottom, large enough to
By means of a collar and ce-
so that it encircled the upper

ance was to have the means of
to the superior portion of a
swered the purpose completely.
ermometer through the tubula-
it nearly reached the axis at
bove the rising of the bottom,
uation, I rendered the aperture
cork and lute.
ed on a table, with the inter-
ick paper, in a room without
2°.

0°, and poured into the bason,
mixture of powdered ice and

ored the temperature near the
ulb of a thermometer to the
in the axis.

p.	Air.
0°	42°

8

In

	Bottom.	Top.	
In 21 minutes	44 —	46 —	
— 31 ———	42	44	
— 41 ———	41	42	
— 51 ———	40· +	34	At this time a thin film of ice began to form in contact with the glass.
— 1 hour 6 min.	40	34	
— —— 20 ——	39·5		
— —— 44 ——	39·5		
— 4½ hours	39·5		A crust of ice of some thickness now lined the glass, and air had fallen to 40°.
— 5½ ——	39		
— 11 ——, *i.e.* at midnight	39		Crust of ice complete.
— 19 ——, *i.e.* next morning	39		Air 40°.
— 26 ——	40·		Air 40°. So much ice had melted that the cake was detached from the side of the vessel, and floated.
— 32 ——	40		
— 41 ——	40		Air 41°. Ice not all melted.
— 50 ——	41		Air 42°. Ice not entirely gone.

This long protracted experiment presents some striking facts, and its general import, with regard to the subject of investigation, agrees with the preceding. In it we see, that when the frigorific mixture abstracted caloric from the upper extremity of a cylinder of water, nearly 18 inches long, and at 50°, the reduction of temperature appeared sooner, and advanced quicker at its lower extremity than in the axis at the top, not two and a half inches distant from the cooling power. No one can entertain a doubt that this is owing to a current of cooled and condensed fluid descending, and a corresponding one of a warmer temperature ascending. Now, if water observed the same law that other bodies do, and had no peculiarity of constitution, the same progress of cooling should continue. This, however, the experiment teaches us, is not the case: as soon as the fluid at the bottom exhibits a temperature of 40°, it ceases. The colder fluid remains at top, and, quickly losing temperature, ere long begins to freeze. The continuance of the colder fluid at the surface surely denotes, that it is not more dense than the subjacent warmer water. The legitimate inference from this is, that water of temperature 40° is not contracted by being cooled to 32°.

sual law, and lose volume along
periment, by its long duration,
manifestation of it.
ys did ice-cold water maintain
the same period the temperature
below 39°. No current, there-
d fluid moved from the surface,
nometer, or to attest the con-

ver, I must remark, does not
at the water is actually expand-
pposes it. It proves no more,
eases at 40°; and that water of
of 39° or 40°. Nay, some may
oes not prove so much; con-
contraction, without ceasing al-
nconsiderable, the difference of
subsequent reduction of tem-
ifling, as not to enable the cold
on which their gravity assigns to
inertia and tenacity of the sub-
that the colder, though heavier
o remain above. That this al-
eight attached to it, the circum-
xperiment will clearly show, as

deration of the present experi-
le to remark, that it may seem
bottom of the fluid was not ap-
perature by the ice which so long
ght be expected, though no cold
bove, that the caloric should be
nd that the temperature should
*. I suppose that the caloric
did

---

s be thought to give countenance to the
nt Rumford, that fluids cannot conduct
eat can take place between the particles
at for two days the fluid at the bottom of
gh the surface was at 32°.
in his seventh essay, the Count conclu-
fluid. From the present, it might with
cannot ascend.
hat this celebrated philosopher has push-
posed to consider this experiment as ac-

tions of the Count appeared, I began to
retty long train of experiments, which I
ty of detailing in my lectures, satisfied
myself

did pass from the lower strata upwards, but extremely slowly, by reason that fluids, as Count Rumford taught us,

---

myself that he assigned to fluidity a character that does not belong to it. Though since the date of these experiments, the public has become possessed of several series, well devised, and, in my opinion, of themselves conclusive, it may yet be worth while to state the tenor and result of them, by which the value of their testimony in favour of the conducting power of liquids may be estimated.

The experiments were of two descriptions.

The one set, of the same nature nearly with those of Count Rumford, was designed to examine, Whether heat, when applied to the surface, can descend in a fluid; and the other, to discover, Whether, on the mixture of different portions of fluid at different temperatures, an interchange of caloric takes place between the particles;—Water, oil, and mercury, having been the subjects of the Count's experiments, were employed for the first set.

To explore the conducting power of water and oil, the apparatus which I used consisted of two vessels of tinned iron, both cylindrical, and the one somewhat larger than the other. The larger had a diameter of eleven inches, and into it were poured the subjects of the trial, to different depths on different occasions. The smaller was ten and a half inches in diameter. By three hooks it was suspended within the larger pan, in such a manner that the bottom of it exactly reached and came in contact with the surface of the fluid. This smaller vessel became the source of the heat, by being filled with boiling hot water. The water was changed frequently, care being taken to avoid, by the use of a syphon, all agitation and disturbance.

In experiments of this nature, the difficulty is to prevent the conveyance of caloric by the sides of the vessel. I attempted, and, I think, I succeeded, in overcoming this difficulty, by encircling the larger vessel, at a height exactly corresponding with that of the surface of the fluid within, with a gutter or channel about half an inch in depth; and by causing a stream of cold water to flow constantly through a syphon into this gutter, while from the opposite side it ran off by a small spout.

The water was several degrees colder than the subject of the experiment; and keeping cool the portion of the vessel with which it was in contact, it intercepted the heat that would otherwise have travelled by this route to the bottom.

For mercury I had recourse to vessels of glass.

In all the experiments a thermometer bore testimony that the caloric descended from the surface to the bottom of the fluid, and demonstrated, at least to my conviction, that fluids can conduct heat.

The progress of the heat, however, was very slow, and attested the important fact, for which we ought to be thankful to the Count,—That fluids are very bad conductors.

The second set of experiments was calculated to examine, in a very different manner, the position, That all interchange and communication of heat between the particles of fluids is impossible.

When a hot and a cold fluid are mixed together and well agitated, very soon an uniform temperature is produced. This equality must proceed either from a communication of heat from the warmer to the colder fluid, agreeably to the common opinion, or from a perfect intermixture of hot and cold particles, according to the notion of Count Rumford. To which cause it ought to be attributed, I conceived I might discover, by ascertaining whether, after such an intermixture, any separation of the hot and cold portions took place. If the equilibrium of temperature be owing to intermixture without interchange of caloric, the hotter particles, as soon as the agitation ceases, ought, by reason of their greater rarity, to accumulate to a certain degree, at the surface, and there exhibit a temperature above the common one.

ductors of heat, and so very
ered from the atmosphere with
nt any depression of tempera-

conclude with remarking, is
ibit the error of the popular
endency to ascend."

ment IV.

and stopping the tubulature
water of temperature 40°, and
uspending two thermometers,
cond, I poured a mixture of
the depth of 4·2 inches, the
s in the last experiment.

fluid boiling hot, with an equal quanti-
ass jar, I shook them well for a short

rature, and raising the ball of the ther-
an opportunity of observing, that it
degree above the common temperature

with alcohol, selecting it on account of
well, for half a minute, a mixture of
40° and at temperature 170°. The re-
104°.
icles at 40° and at 170°, as the difference
at these temperatures is very consider-
r and lighter particles from the others,
e. The temperature of the top, how-
warmer particles. It never ascended

d, that the uniformity of temperature
unication and interchange of heat be-

r to state, that Count Rumford, with
leasure of conversing upon this subject,
be so complete as to prevent any sepa-

idity, that heat cannot pass from one
different fluids ought to be equally in-
ly to each other. Unfortunately, how-
is so communicated. Though, *à priori*,
e result of the experiment, I poured a
en heated by immersion in a vessel of
an equal volume of water of 38°, and
for a quarter of a minute. The com-
°, and the heat had gone from the oil
separated, and had arranged themselves
th of them had the same temperature of

iptions now recorded, left on my mind
trained his conclusions.

Eleven

	Bottom.	Top.	Air.
Eleven o'clock	40°	40°	40°
In 10 minutes	38+	38+	
— 20 ———	38—	38—	
— 30 ———	37—	37—	
— 40 ———	36	36	
— 60 ———	35·5	35·5	
— 80 ———	35	35	
- 100 ———	34·5	35	
- 120 ———	34—	34	
— 8 hours	34—	34	

A crust of ice began to form on the inside of the glass when the water in the axis of the bottom and of the top was at 36°. In the course of the experiment, it became at least an inch thick.

We learn from this experiment, that cold applied to the lower part of a cylinder of water, nearly 18 inches long, and having the temperature of 40°, is actually as speedily perceived at the summit as in the axis of that part, on the external surface of which it immediately acts. As fluids conduct heat so very tardily, this can only arise from currents of cooled water ascending from the bottom, and these cold currents could not move upwards, were not the water of them specifically lighter than that of the incumbent warmer fluid.

The water, therefore, which at the bottom is cooled by the contiguous frigorific mixture, must be expanded by the loss of caloric.

This experiment secures full force to the last, as it obviates the objection already noticed, and also precludes another. I have already stated, that it may perhaps be alleged, that the fluid at the top, in experiment third, though cooled to 32° did not descend, because below 40° the contraction is so trifling, that it does not occasion a difference of specific gravity sufficiently great to cause the particles to descend, when opposed by the inertia and tenacity of the fluid through which they have to fall; or it may be conceived, that the descent is so tardy, that time is given to the ambient air or subjacent fluid to furnish heat enough to raise the temperature of the descending stream, and by that arrest it in its downward course.

But from the particulars above recorded, it is manifest, that the change of density between the temperature of 32° and 40° is quite sufficient to put into motion the particles, and to enable them to overcome the obstacle arising from inertia and tenacity, and to withstand the arresting effects of atmospheric heat.

s, and some others of a similar
o my mind, and perfectly satis-
y of the anomaly of water, I
at the mode of making the ex-
ll more striking results.

, I used an apparatus which
It was 21 inches high, and 4
he middle of its height a per-
, 2 inches in depth, and 10 in
nbraced the middle of the jar,
ot water, or a frigorific mixture,
iddle portion of the fluid in the
ermometer, learn what course
ould take.

iment V.

at 32°. I placed it upon seve-
viously cooled to the same de-
going from 33° to 35°, I intro-
as in experiments first and se-
r of temperature 68° into the
out arising from the side of it,
ith a reservoir of water at the
, I renewed the contents of the
ut causing any agitation.

Top.	Air.
32°	33—35
32	
32	
32	
33	
33	*** From this time I charged the bason with water of temperature 88°, and renewed it frequently.
33	
33	
44	
45	
48	

sive with regard to the question
ars of this experiment. Heat
a column of ice-cold water.
equal share of the column of
th it. There is nothing to de-
ection or another, excepting its

s that the warm current sets
increased temperature to the
ment indicates the successive
rise

rise of several degrees, before the surface indicates the smallest acquisition of heat.

The inference is plain, that the cold water is contracted by the heat.

The change of the effect of heat is equally well illustrated by this experiment.

No sooner did the inferior portion attain the temperature of 39°, than the heated fluid altered its course, and, by ascending, carried the increase of temperature very rapidly to the surface, so that it soon surpassed the bottom, and continued to rise, while the other remained stationary.

Experiment VI.

I filled the jar used in the last experiment with water of temperature 39½°, the air and the support being at 39°. Disposing the thermometers in the usual manner, I introduced a mixture of snow and salt into the bason.

	Bottom.	Top.	Air.	
At commencement	39·5	39·5	39°	
In 10 minutes	39+	38+		
— 25 ———	39+	36·5		⁂ At this time ice began to be formed on the side of the vessel.
— 35 ———	39	36−		
— 55 ———	39	35		
— an hour and 10 min.	39−	34+		
— ——— 35 ———	39−	34−		
— 2 hours	39−	33+		

This experiment speaks in as decided language as the preceding. It shows that when a portion, in the middle of a column of water at temperature 39·5 is cooled, the colder fluid rises, and does not descend through the warmer mass, and presents the unequivocal demonstration, that water of temperature 39½° is actually expanded by losing heat.

The different experiments which I have in detail recorded, agree perfectly with each other in the evidence they give relative to the subject of inquiry. The general import of them is, that water which is ice-cold, or a few degrees warmer, when heated, becomes specifically heavier,—that water of 40° when heated becomes specifically lighter,—that water above 40°, by the loss of heat, or by cold, is rendered specifically heavier; and that water below 40° is, by the same cause, rendered specifically lighter.

Such being the general import, the conclusion is irresistible, that heat, in low temperatures, causes water to contract, and at superior temperatures to expand. The opinion, therefore, is founded in truth, that water possesses

itution in relation to the effects
ithin a short range of tempera-
eneral law of " expansion by

n these experiments, I am dis-
oint at which the change in the
relation to heat takes place, lies
th degree.
of any objection to the method
ng this singular anomaly, and
ich may have arisen from the
n the instrument must have in
investigation that had previ-

ove described, however, only
s no data for ascertaining the
ffect of heat.
M. de Luc alleged, that from
expansion occasioned by cold
t produced by the same num-
consequently that water pos-
y given number of degrees of
w 41°. The first experiments
confirm this opinion, and to
it applied, by extending it to
°, as water allows itself to be
eze. From one circumstance
am inclined to think, that the
cold is inferior to that caused

oling of water below 40°, the
etween the top and bottom of
occurred during the cooling or
h the same number of degrees
at, when other circumstances,
he change, are alike, the dif-
veen the upper and lower parts
pon, may prove a measure of,

cooled, presents, by reason of
reater difference of temperature
er; and upon the same principle
is more expanded by an equal
ion than of depression.
testimony of the experiments
ral opinion, will probably re-
move

move every doubt respecting the matter of fact, it remains a very difficult problem for those who are fond of philosophical investigation, to explain how heat shall occasion in the same fluid, without producing any alteration of mechanical form or chemical condition, at one time contraction and at another expansion, and to reconcile the contractive effect to the conceived notions of the mechanism of the operations of this energetic agent.

When heat causes expansion, it is imagined to act by inducing a repulsion among the particles of bodies, which, opposing and overpowering the cohesive attraction, causes the particles to recede.

In what manner, then, the addition of heat can occasion, or allow, the particles of water to approach each other, and how the subtraction of it can make them retire to a greater distance, I confess I can in no measure comprehend.

An explanation, abundantly plausible at first view, very readily suggests itself to every one who is aware of the great and forcible expansion which happens to this fluid at the moment of its congelation. It is stated by sir Charles Blagden, in the paper already quoted.

The remarkable dilatation which water experiences at the instant of being converted into ice, is very generally ascribed, and I presume very properly, to a new arrangement which the particles assume, determined probably by their polarity; by which one side of the particle A is attractive of one side of B, while it is repulsive of another.

Now, if this polarity operates with so much energy as to impart almost irresistible expansive force at temperature 32°, it is reasonable to suppose that it may begin to exert its influence, though in a far inferior degree, at temperatures somewhat more elevated. The expansion, therefore, that takes place, during the falling of temperature from 40°, may be imputed to the particles beginning or affecting to assume that new arrangement which their polarity assigns them, in which arrangement these particles occupy more space than before.

Again, when heat causes water of 32° to contract, upon the same principle it may be conceived to operate by counteracting the small portion of the disposition to polarity that survives the liquefaction.

I am afraid that we cannot rest satisfied with this explanation. We must not be deceived by the plausibility of it.

The state of perfect fluidity depends upon the circumstance,

f any body admit of ready mo-
that the change of relative situa-
sensible resistance.
s fluidity in a great degree, and
encounter but little resistance,
the other. But if these particles
ree of polarity, by which certain
d to attach to each other than
y would necessarily oppose that
position, which is essential to
t impair the fluidity, and induce
iscidity.
, water at 32° has its fluidity as
nsiderably elevated. Unwilling
ere experiment might decide, I
ways to ascertain whether the
liminution in this respect while
e following method I deem the

yed a gravimeter, the one con-
or discovering the weight and

trument, but, unfortunately, it
as a balance. Duly loaded, so
the water in which it is plunged,
sensible to the 20th part of a
though its stem be slender, is
n two or three twentieths of a

the gravimeter arises, in a great
rely, from a certain degree of
the particles of the fluid; and
ease this tenacity, must, in the
this want of sensibility.
sensible change in the tenacity
e expansion of water by cold,
I examined the mobility of the
in water at different tempera-
to this fluid, heated to between
loading, which sunk it to the
ot sensible to a weight less than
grain.
water, and found that its sen-
le degree impaired. The cold-
t be remembered, causes some
gravimeter. This contraction
cannot

cannot fail to render the instrument in some small measure more sensible, and, so far as it goes, to counteract the sluggishness produced by any increased tenacity in the fluid.

But as the body of the instrument is made of glass, the amount of the contraction must be very small, and the change of sensibility arising from it so very trifling, as certainly by no means to obscure such an effect as an increase of tenacity would occasion. I therefore with some confidence conclude, that the fluidity of the water is not sensibly diminished, and consequently that the polarity has not begun to exert any sensible influence; it can scarcely, therefore, be accounted the cause of the dilatation.

XXXVI. *On an artificial Substance which possesses the principal characteristic Properties of Tannin.* By CHARLES HATCHETT, *Esq. F.R.S.*[*]

§ I.

THE discovery of the principle on which the effects of tanning essentially depend, may be partly attributed to M. Deyeux, who obtained a substance from galls which he considered as a species of resin [†], but which was afterwards proved by M. Seguin to be that which renders the skins of animals insoluble in water and imputrescible, and thus to be the principle by which they are converted into leather [‡].

The chief characteristic property of this substance was ascertained by M. Seguin to be that of precipitating gelatine or glue from water in a state of insolubility; and as it was evidently different from any vegetable substance hitherto discovered, he gave it the name of tannin.

This discovery of M. Seguin at once unveiled the theory of the art; an easy and certain method was afforded by which tannin could be detected, and its relative quantity in different substances be determined, whilst the nature and properties of this newly discovered vegetable principle could be subjected to accurate investigation.

The former has derived elucidation from the experiments of Mr. Biggin [§], and much has been contributed in every respect by M. Proust [||]; but the subject has received the

---

[*] From the *Transactions of the Royal Society for* 1805.

[†] *Mémoire sur la Noix de Galle*, par M. Deyeux; *Annales de Chimie*, tome xvii. p. 23.

[‡] Ibid. tome xx. p. 15.

[§] Phil. Trans. 1799, p. 259.

[||] *Annales de Chimie*, tome xxv. p. 225. Ibid. tome xli. p. 331. Ibid. xlii. p. 89.

of the most valuable additions
of Mr. Davy, particularly the
act, that catechu or terra japo-
nnin *.

xperiments made by these and
ar therefore to have fully esta-
eculiar substance or principle
nd exists in a great number of
-bark, galls, sumach, catechu,
anied by extract, gallic acid,

upposed that it could be pro-
noticed by M. Chenevix may
tion of it.
t a decoction of coffee-berries
nless they had been previously
n this case either been formed
the other vegetable principles

have however convinced me
he chief characteristic proper-
d by very simple means, not
en from mineral and animal

II.

iments on lac, and on some of
o notice the powerful effects
cid; and I have since observed,
t every species of resin is dis-
changed, that water does not
l that by evaporation a deep
ained, which is equally soluble
hat the resinous characters are

iscovered a natural substance,
of a resin similar to that of re-
f asphaltum ‡, I was induced
lready mentioned to the bitu-
ng some characteristic proper-
riginal identity of these bodies
ight be further corroborated.
in some measure, better than I
ery material difference between

---

l. ii. p. 114.

the solutions of the resins and those of many of the bitumens, such, for instance, as asphaltum and jet. The first effect of nitric acid, during long digestion with these substances, was to form a very dark brown solution, whilst a deep yellow or orange coloured mass was separated, which by subsequent digestion in another portion of nitric acid was completely dissolved, and by evaporation was converted into a yellow viscid substance, equally soluble in water and in alcohol, so as to perfectly resemble that which by similar means had been obtained from the resins, excepting that when burned it emitted an odour somewhat resembling that of the fat oils.

It therefore appeared to me that the first or dark brown solution had been formed by the action of the nitric acid on the *uncombined* carbonaceous part of the bitumens, or that by which they are rendered black, and that the deep yellow portion which was separated was that which constituted the real or essential part of these bituminous substances. This opinion was confirmed by some experiments which I purposely made upon amber; and having every reason therefore to believe that the dark brown solution obtained from asphaltum and jet was in fact a solution of coal, I repeated the experiments on several varieties of the pit or mineral coal, from all which I obtained the dark brown solution in great abundance; but those coals which contained little or no bitumen did not yield the deep yellow substance which has been mentioned.

In each experiment I employed 100 grains of the coal, which I digested in an open matrass with one ounce of nitric acid diluted with two ounces of water. (The specific gravity of the acid was 1·40.)

After the vessel had been placed in a sand-bath, and as soon as it became warm, a considerable effervescence, attended with much nitrous gas, was produced: after about two days I commonly added a second and sometimes a third ounce of the acid, and continued the digestion during five or six days, or till the whole, or nearly the whole, was dissolved, excepting in those cases when the deep yellow substance was formed; for this I constantly separated.

The next experiment was made upon charcoal, which was more readily dissolved than the preceding substances, without leaving any residuum; the solution was perfect, and the colour was reddish-brown*.

Having

---

* The solubility of charcoal in nitric acid, and some of its properties when thus dissolved, have been noticed by professor Lichtenstein in Crell's Chemical

s of nitric acid obtained solutions
t, from several of the pit-coals, and
ated them to dryness in separate
e latter part of the process to eva-
o as completely to expel the re-
ut burning the residuum; this, in
a brown glossy substance, which
ure.

s of these residua were as follows.
dissolved by cold water and by

ighly astringent.
y smoked but little, swelled much,

ater reddened litmus-paper.
copiously precipitated the metallic
f tin, acetite of lead, and oxysul-
r of these precipitates was com-
o that of chocolate, excepting the
ray.
ld from its solution, in the me-

ed the earthy salts, such as the
&c. &c.
well as ammonia, when first added
epened the colour, but after some
d.
immediately precipitated by these
the precipitates were more or less
ength of the solutions. The pre-
le in cold and in boiling water, so
erties they proved similar to those
tannin hitherto known, with the
ous substance appeared to be ex-
nd mucilage, which commonly
of tannin, and which occasion
r and appearance of some of their

tisfaction to discover that a pro-
uld be formed by such a simple
egetable, but also from mineral
mine how far the same might be
nd I therefore reduced a portion

Lowitz (Crell's Chemical Journal, trans-
; and by Mr. Jameson, in his Outline of
lands, &c. 8vo. edit. p. 167.

of isinglass to that state in a close vessel, and having rub the it into fine powder, I digested it with nitric acid in bed manner which has been described. At first the acid did not appear to act upon it, but at length it was slowly dissolved excepting a small quantity, which however was in every respect unchanged; and here we may remark, that as animal coal is incinerated with much more difficulty than vegetable coal or charcoal, so was the same difference to be observed when oxygen was presented to these bodies in the humid way.

The solution resembled those which have been described, excepting that the brown colour was more intense. It was evaporated to dryness, and was then dissolved in distilled water, after which the solution, being examined by the reagents which had been employed in the former experiments, was found to produce similar effects, excepting some difference in the colour of the precipitates.

I next added some of the liquid to a solution of isinglass, and obtained a copious precipitate. Thus it is evident, that a tanning substance may be formed from animal as well as from vegetable and mineral coal; and it is not a little curious, that this enables us to assert as a matter of fact, although not of œconomy, that one portion of the skin of an animal may be employed to convert the other into leather.

In the course of these experiments I also subjected coak to the action of nitric acid, and obtained a product which resembled that which had been afforded by pit-coal; but in this case (as might be expected) there was not any appearance of the deep yellow substance which has so often been mentioned.

These experiments, therefore, prove, that a tanning substance may be artificially formed by exposing carbon to the action of nitric acid; and it also appears, that this is best effected when the carbon is uncombined with any other substance excepting oxygen. The following experiments seem to corroborate this opinion.

1. A piece of Bovey coal, which had perfectly the appearance of half-charred wood, was reduced to powder, and was digested with nitric acid until the whole was dissolved.

The colour of the solution was deep yellow; and, by evaporation, a yellow viscid mass was obtained, which was dissolved in distilled water. This solution was then examined by various reagents, and particularly by gelatine, but not any vestige of tanning matter could be discovered, and the predominant substance appeared to be oxalic acid.

ey coal, which had less of the
more perfectly carbonized, was
as been described; the solution
former, afforded a considerable

sort of Bovey coal was exposed
ssel, and was then reduced to
nitric acid; here a remarkable
d, for nearly the whole was thus
ubstance.
xtremely like the second sort of
e same product.
rand from Iceland yielded a si-

as digested with the nitric acid
olved; by evaporation a yellow
the solution of which in water
of the first experiment on the
was found in it, but not any of

e same deal saw-dust was con-
se vessel; the charcoal was then
ly described, and was thereby
copiously precipitated gelatine.
certained that teak wood does
tannin, I reduced some of it
fterwards readily converted into
ed.
e deal and the teak wood had
coal, as usual, by fire; but as
e been the means generally em-
t organized substances into the
for a considerable time previous
ficial tanning product had been
periments on the slow carboni-
of vegetable substances by the

commonly used to produce this
asionally diluted; and although
extremely unpleasant and tedi-
son to regret the time which has
subject, however, I foresee will
ils, none of which as yet I can
pleted to merit the honour of
arned society; but I am in a
n the present case to anticipate
a few

a few of the experiments, with their results, because they are intimately connected with the subject now under consideration.

In these experiments I have observed that concentrated sulphuric acid, when poured upon any of the resinous substances reduced to powder, dissolved them in a few minutes; at this period the solution was transparent, commonly of a yellowish-brown colour, and of the consistency of a viscid oil. But if, after this, the vessel was placed on a sand-bath, the colour of the solution became progressively darker, sulphureous gas was evolved, and at length the whole appeared like a very thick liquid of an intense black. I purposely for the present pass over many phænomena, some of which are peculiar to the different substances when thus treated, whilst others are general, and may be referred to those attendant on etherification, for my intention here is only to notice, in a concise manner, such as immediately tend to elucidate the subject of this paper.

When concentrated sulphuric acid is poured on the common turpentine of the shops, it almost immediately dissolves it like the solid resins; and if a portion of this solution be poured into cold water, the turpentine is precipitated in the solid brittle state of common yellow resin. But if a second portion of the same solution, after the lapse of an hour or more, be in like manner poured into cold water, the resin thus formed is not yellow, but dark brown; and if four or five hours are suffered to elapse before a third portion is poured into water, the resin is found to be completely black. After this, supposing the digestion to be carried on during several days, or until there is no longer any production of sulphureous gas, the turpentine or resin will be found converted into a black porous coal, which, if the operation has been properly conducted, does not contain any resin, although a substance may frequently be separated by digestion in alcohol, which I shall soon have occasion to notice.

When common resin was thus treated, I obtained about 43 per cent. of the coal, which, after being exposed to a red heat in a loosely covered platina crucible, still amounted to 30 per cent., and by the slowness of its combustion and other circumstances which need not here be related, approached very nearly to the characters of some of the mineral coals*.

The

---

* The difference of the quantity of carbon, which may be obtained in the state of coal from resinous substances by the humid and by the dry way, is

sulphuric acid upon turpentine
aused by the union of the two
e latter (namely, hydrogen and
xygen of the former, so that sul-
coal are produced. I therefore
ss, by which coal could be pro-
he original substance was gradu-
the following experiment.
turpentine was treated with sul-
which has been described, and
lution being poured at different
he remainder was digested during
ed, from the same original sub-
n resin, black resin, and coal.
f each of these, as well as some
ate vessels with nitric acid until
solved, and afterwards reduced
fferent residua varied in colour
, corresponding to the substances
. These were then dissolved in
xamined by solution of isinglass

esiduum of turpentine was pale
recipitate gelatine.
resembled the former in every

sin was of a deeper yellow, but
ed the above.
n, on the contrary, yielded a con-
ning substance,—and
ded it in great abundance.
these different modifications of
ing substance only in proportion
ginal carbon, which, by oxidize-
ly converted into coal*.
reduced into coal in the humid
formed into the tanning sub-
fact I found this to be the con-
he many substances which were

---

common resin as an example, for when
distillation in a small glass retort placed
iduum of coal only amounted to three-

owever convinced me that carbon need
al in order to produce the artificial tan-
more fully explained in a subsequent

examined, I shall mention various kinds of wood, copal, amber, and wax, all of which, when reduced to coal by sulphuric acid, yielded similar products, by subsequent treatment with nitric acid.

But this substance may likewise be artificially produced without the help of nitric acid, although in a less proportion, as well as with some slight variations in its characteristic properties; for, as I have already observed, when any of the resins or gum resins (such as common resin, elemi, assafœtida, &c.) have been long digested with sulphuric acid so as to assume the appearance and general characters of coal, if afterwards they are digested with alcohol, a portion is dissolved, and a dark brown solution is formed which by evaporation yields a mass soluble in water as well as in alcohol, and which precipitates gelatine, acetite of lead, and muriate of tin, but produces only a very slight effect on oxysulphate of iron. This substance, therefore, which may thus be separated by alcohol from the coal formed from resinous bodies by sulphuric acid, evidently contains some of the tanning matter, which has been produced during the carbonization of those substances.

A natural process very similar to this I much suspect takes place in some cases where peat is formed; I say in some cases, because the production of tanning matter does not seem to be absolutely a necessary consequence attendant on the formation of peat; for in many places where the latter abounds the former cannot be detected, whilst in others it is very abundant, and acts powerfully on animal bodies which have accidentally been exposed to its effects.

There are many facts of this kind upon record, such as the account of the bodies of the man and woman preserved in the moors near the woodlands in Derbyshire, and also of the woman found in the morass at Axholm, in Lincolnshire*. Now I am much inclined to believe, that the tanning substance which so much abounds in these and some other peat moors, did not originally exist in the vegetable substances from which the peat has been produced, but that it has been and continues to be progressively formed (under certain favourable circumstances) during the gradual carbonization and conversion of the vegetable matter into peat.

§ III.

In most of the former papers which I have had the ho-

---

* Phil. Trans. vol. xxxviii. p. 413. Ibid. vol. xliv. p. 571.

yal Society, I have, for greater
ided with a recapitulation of the
t case this appears to be super-
e concentrated into one simple
nce very analogous to tannin,
nsidered as one of the proximate
y at any time be produced, by
tances, whether vegetable, ani-
on of nitric acid,
iments were made, I have fur-
his substance by actual practice,
o leather by means of materials
n, must appear extraordinary,
phaltum, common turpentine,
piece of the same sort of skin.
t the production of this sub-
be principally regarded only as
altogether unimportant, yet, as
s founded appears to be deve-
more œconomical process will
tanner may be enabled to pre-
the refuse of his present ma-

nd their products have only of
e attention of chemists, many
e, (although the modes of che-
n so much improved) seem dis-
e Proteus-like changes which
ubstances are subjected to ex-

dless alterations of their proper-
o operate as incitements to in-
mulation of facts resulting from
ese bodies by disuniting and by
tary principles, not only will
come further illumined and ex-
has hitherto done, render great
arts and manufactures.

---

gs of Learned Societies.

ETY, LONDON.

ety commenced, after the sum-
, November 7, the hon. Mr.
Greville,

Greville, in the chair. The business of the season opened, as usual, with the Croonian lecture, by Mr. Carlisle, *on the Power and particular Structure of the Muscles of Fishes.* The excellence of Mr. Carlisle's former lecture on muscular motion awakened curiosity; and if in the present he has been less successful, it is perhaps rather owing to the more limited nature of his subject, than to the want of original observations and experiments. After several minute physiological explanations of the nature and peculiar structure of the muscles of fishes, and their invariable insertion in fleshy instead of tendinous matter, the author proceeded to detail his experiments on their power and particular use, in enabling the animal to move with so much rapidity through a fluid so dense as water. He ascertained that the muscles of the sides and tail are solely those by means of which the fish advances; that the pectoral and abdominal fins serve only to raise or lower, and balance it in the water; and that, deprived of these muscles and again put into water, it remained at the bottom without being able to ascend, but with the power of advancing as before. By cutting off the pectoral and abdominal fins of one side, the fish lost the power of balancing itself upright, fell on its side, and advanced slowly. He accounted for what is vulgarly called drowning in fishes, when caught by the angler's hook, from the very great violence with which they at that time strike the water, and consequent prostration of strength in the muscles, that they fall on their side or back, and appear as if drowned. The effect would be the same if the hook was placed in any other part of the body as well as the mouth; exhaustion, and not suffocation being the cause.

On the 14th, the reading of this interesting paper was concluded. The fluids of fishes coagulate at about 160° of Fahrenheit.

On the same evening was read the Bakerian lecture *on the Force of Percussion,* by Dr. Wollaston, secretary of the society. The nature of mathematical discussions renders analysis extremely difficult, although Dr. Wollaston's lecture possesses the rare merit of brevity and perspicuity. The hitherto undefined, and perhaps undefinable force of animal power has long exercised the ingenuity of mathematicians, and Dr. Wollaston has wisely contented himself with following Smeaton on that subject. His illustration of the force of percussion, however, and of accelerated motion, he conceives to be somewhat novel, and to contain s predecessors; it has certainly

ANTIQUARIES.

ety took place on the same even-
receding that of the Royal. On
a bronze bas-relief of a boy rid-
somewhat depressed resembling
s and highly interesting piece of
hester; but the discoverer could
of its nature or use. He sup-
f the *Dii Penates* or *Lares*, and
the god of love, in one of the
the antients adored that power-
nitted an observation different
es, we would pronounce it not
ted on a dolphin, the head of
ng the descent of the jolly god
g to the modern system of ex-
nblematic of the sun's setting
figure is supposed to have been
the inhabitants of the north-
os, where their Cimmerian Tar-
covery of this bronze bas-relief
re accurate knowledge of the

ver coins of Edward III., and two
of Claudius) were exhibited.
e bed of the Thames, opposite
o drawings of paintings, disco-
of St. Stephen's chapel, West-
l. They are about three feet by
persons around a table in one
of three female figures with an
saintship. Both the male and
e air of Normans: perhaps the
at country.
was occupied with the election

IONAL INSTITUTE.

mathematical science proposes
hich it will adjudge in the pub-
nday of Messidor, in the year
which it remits to the meeting,

ations and by anatomical and
chemical

chemical experiments, what are the phænomena of the torpor which certain animals, such as marmots and dormice undergo during winter, with respect to the circulation of their blood, their respiration, and their irritability; also to inquire what are the causes of this sleep, and why it is peculiar to those animals.

It is required that a precise detail be given of the ordinary temperature of these animals, of the degree of cold necessary for their torpor, of the natural temperature which they retain during their lethargy, of the time which is necessary for them to resume their natural temperament when they waken; of the quickness of their pulse during the two states; of the quantity of oxygen which they consume in a given time, both in their quick and torpid state; of the profoundness of their torpor, both with respect to their sensibility and to their simple muscular irritability; finally, of the colour and the chemical state of their blood.

The proposers of the prize do not require that the experiments be made on all dormant animals; only that they be made with strictness on the kinds most easy to be procured.

The prize will be a kilogramme of gold (about 3,400 francs). The memorials sent for competition must be remitted to the secretaryship of the Institute before the first Germinal, of the year 15.

Conditions of the Competition.

All persons excepting the members of the Institute are admitted to the competition.

No work that is sent to the competition is to bear the name of the author, but only a sentence or device.

It is allowed, if the writers choose, to attach a separate and sealed note, which shall inclose, besides the motto or device, the name and address of the author. This note is not to be opened unless the piece obtain the prize. The works destined for competition may be sent to the office of the secretary, franking the packet which contains them. The clerk of the secretaryship will give receipts for them. They may also be addressed, carriage paid, to the perpetual secretaries of the physical and mathematical sciences.

The competitors are informed, that the Institute will not return any of the works which shall have been sent to the competition. The authors shall have liberty to take copies of them, if they have occasion. The administrative commission of the Institute will deliver the gold medal to the bearer of the receipt. In case there shall have been no receipt

not be sent, but to the author
hom he shall employ.

ADEMY, PARIS.

eting submitted to the test an in-
f its members, which communi-
nding and conversing with per-
u are entirely ignorant, without
out expense, without embarrass-
xertions. It was tried by twen-
European languages, and this
means of this discovery, a per-
pleases without an interpreter;
ing he wants, converse on every
to a traveller, and even express
process is intended to be made

CIETY, MANILLA.

as, has published in the Madras
ter, which he had lately re-
nnouncing the formation of a
:

ted here, under the immediate
a literary society, to which they
to appoint me secretary. The
is to produce a journal every
rent branches of useful sciences
n order to encourage industry,
storical extract of these islands
their establishment by the Spa-
st approved authors on this sub-
tition in the antient relations.
f the three kingdoms, the ani-
mineral. Agriculture will oc-
ommerce and industry will fur-
hing upon navigation. A few
the remarkable events of every
occurred, with observations on
This is nearly the plan, which
re of by the prospectus, which
sending to you by the first op-
ent in the press, and will not
month. The society, wishing
on and light which can tend to
ful, and at the same time enter-

into a correspondence with the other different societies who are occupied by the same views, have requested me, and in particular the president, don Domingo Goyena, to inform the society at Madras of their intentions by this opportunity, until they can do it more formally by sending the prospectus of their journal. Not knowing any of the other members of this society excepting you, sir, I take the liberty to request you will engage the learned members of your assembly in favour of this infant society—*Friends of Luçonia*—and engage them to admit with benevolence the request to enter into correspondence, and make known to this infant in the cradle their lights, their works; and, in fine, to assist it with their succour, that it may one day be enabled to tread in the steps of its masters. I cannot help being extremely flattered, sir, by a commission which brings to my recollection a person of your merit, and which will often give me the opportunity to assure you of the sentiments of respect and high consideration with which

"I have the honour to be, Sir,
"Your very humble and very obedient servant,
"J. M. Dayot."

Manilla,
10th Feb. 1804.

SOCIETY AT BOMBAY.

A society has been instituted at Bombay for the purpose of collecting useful knowledge in every branch of science, and of promoting the further investigation of the history, literature, arts and manners of the Asiatic nations. Sir James Mackintosh, who was elected president, delivered a very eloquent discourse on the occasion.

XXXVIII. *Intelligence and Miscellaneous Articles.*

VACCINATION IN INDIA.

To the Editor of the Government Gazette.

SIR,

The settlements of Columbo, Madras, and Calcutta, having started nearly at the same time in the race of vaccine inoculation similarly equipped, it may be worthy of inquiry, how so great a difference should exist in their progress as appears by public papers; seeing that some time ago, when the vaccine returns at Madras gave 145,000, those at Calcutta were only 11,000,; and now, by the Ceylon Government Gazette of the 5th instant, 26,000 persons have been vaccinated there notwithstanding the pressure

land, and on the last returns of
re amount to 216,000.
d inconveniences occasioned by
coast nor Bengal have been ex-
cannot be held as a sufficient rea-
ne zeal of professional men every
ceptions, having been nearly the
ore remains a desideratum; but
perations having lately excited a
ions amongst several gentlemen
ders it in some degree proper to
of a permanent and fixed institu-
e may have vaccine inoculators
or a similar manner to such use-
see detailed by me, in a letter to
kpatrick, page 89 of the accom-
ou may therefore reprint in the
with this letter.
Sir,
our very obedient servant,
J. ANDERSON.

---

es Achilles Kirkpatrick.

r hardly admitting room for an-
's queries, I must again trouble
which I have given to his question
ent bears to the year's crop" more
e practice at the village of Nun-
situated, which may serve to give
of grain, the greatest necessary
where it grows; a practice that
eservation of good-will between
ty.
amilies of labourers have twenty-
they cultivate 160 cawnies* of
vernment, and 40 cawnies of free
only relates to the first, it will
e cawnie generally produces sixty
ich, when cut and gathered into a
give one marcal to the carpenter
her to the washerman and barber.

57,000 square feet.
eight measures.

A bundle of the straw, containing one measure* of paddy†, is folded up and given away, when the crop is divided with government, to Pulliar church, another to the Eesvaren church, Permall church, the Vadum schoolmaster, the water-charity pandall, the village beadle, the amildar office water-woman, the doctor, the taylor, the man who burns the dead and waters the fields.

When the heap is trodden and separated from the straw, the taylor sings a song to render the crop propitious, for which he gets a measure of the unwinnowed grain.

When the crop is properly cleaned, the church of Eesvaren, the church of Permall, the church of Peduareear, the village extra servant, the Vadum schoolmaster, the dancing girls who attend marriages and funerals, and the lamp-oil for the amildar's office, have each two measures.

The village clerk six measures; the watchman, by guess of hand, one measure; Pulliar church, half a measure; the water-charity pandall, the same quantity; as well as the village carpenter, ironsmith, washerman, barber, beadle, water-woman, and doctor.

After the above business is over, the village clerk distributes, to the cultivator, two marcals and seven measures; the head man of the village, one marcal and two measures; the watchman, one marcal; the village servants, altogether six measures; the head bramin, two measures; Caulatapetty church, five measures; Eesvaren church, one measure and a half; Permall church, one and a half; repair of the tank, one marcal and four measures.

The remaining grain is then divided between the cultivator and government, deducting one marcal and a half from government's share for the watchman and clerk's fees.

Fort St. George,
May 21, 1798.

JAMES ANDERSON.

PRESERVING OF HOPS.

The following method of preserving hops is given in Klaproth's Journal of Chemistry:

The author, from experiments he has made, proposes to distil the hops with water: when the distilled water is drawn off, the essential oil which floats on the surface is to be separated; the refuse which remains in the still is to be well squeezed, and boiled a second time, after which it is to be evaporated to the consistence of extract, adding a little distilled water. When required for use, the essential oil le sugar, then diluted with the The beer is rendered somewhat the author concludes that one of hops, or obtain beer which suming no more hops than usual. ears when hops are scarce, to *nyanthes trifoliata*, (the common il, marsh clover) taking care to of hops.

---

* A measure is thirty-four ounces.

† Paddy is rice in the husk.

ess it is not easy to perceive that extra labour, which is not se- in the beer itself as is usually is, Whether a larger portion of s can, in a plentiful season, be kind of extract recommended, s themselves. It is certain that issipated from hops kept in bags probably a better way to prevent king them up in tight casks, to

RONOMY.

sion and Declination of Ceres,
o, for December 1805.

PALLAS.				JUNO.				
A R.		Dec. S.		A.R.			Dec. S	
m	s	°	′	h	m	s	°	′
59	24	32	34	11	17	48	1	2
56	48	32	51	11	20	48	1	17
54	12	33	3	11	23	36	1	30
51	32	33	10	11	26	20	1	43
48	52	33	11	11	28	52	1	54
46	20	33	9	11	31	16	2	4
43	52	33	1	11	33	28	2	13
41	32	32	49	11	35	28	2	21
39	24	32	32	11	37	20	2	27
37	24	32	11	11	39	0	2	32
35	44	31	45	11	40	28	2	35

in No. 88, the hours, instead of being con- e first and second lines, viz. "7" in the arked "0".

THE

THE IBIS.

In our present number we have given a skeleton of this antient sacred bird of the Egyptians. An engraving of the bird itself, accompanied with a description, was given in our eighth volume.

LIST OF PATENTS.

A grant unto Richard Kentish, late captain in the Cambridgeshire militia, but now of Birmingham, in the county of Warwick, esq.; for his invented armour waistcoat, which is a sure defence against the bayonet, sword, pike, or any pointed instrument, and in many instances may prevent the wound from a musket ball. Dated Oct. 30.

To Joseph Huddart, of Highbury Terrace, in the county of Middlesex; for sundry new improvements in the manufacture of large cables, and cordage in general. Dated October 30.

To Samuel Meller, of Gresse-street, in the county of Middlesex, engineer; for certain improvements on steam engines. Dated October 30.

To John Hartop, of Brightside, in the county of York, iron-master; for certain improvements in the method of preparing malleable iron for the purpose of making the same into bars, sheets, and slit rods, and manufacturing the same also into hoop iron, and that he has invented certain improvements in the method of preparing all other malleable metals. Dated November 7.

To John Trotter, of Soho Square, in the county of Middlesex, esq.; for a rotatory engine for applying the powers of fluids as first movers. Dated November 14.

To William Milton, vicar of Heckfield, in the county of Southampton, master of arts; for a mode of rendering carriages in general, but particularly stage coaches, more safe than at present, and various other improvements upon such carriages. Dated November 16.

To John Curr, of Sheffield Park, in the county of York, gentleman; for a method different from any that has hitherto been invented or known of laying a rope; or, in other words of twisting and forming the strands together that compose the round rope. Dated November 16.

To Andrew Flint, of Gee-street, Goswell-street, in the county of Middlesex, millwright, for a machine upon an improved construction, which may be used as a steam engine. Dated November 16.

ROLOGICAL TABLE

REY, OF THE STRAND,

November 1805.

Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
29·40	0°	Rain
·64	15	Cloudy
·55	0	Rain
30·00	20	Fair
·40	15	Foggy
·15	27	Cloudy
·08	25	Fair
·35	15	Fair
·32	17	Fair
·39	0	Foggy
·39	0	Cloudy
·38	0	Foggy
·36	2	Foggy
·20	3	Cloudy
·16	5	Cloudy
·32	10	Cloudy
·30	6	Cloudy
·40	18	Cloudy
·52	15	Fair
·65	18	Cloudy
·65	18	Cloudy
·55	15	Fair
·18	20	Fair
·05	0	Foggy
·25	10	Fair
·36	12	Fair
·20	10	Fair
·28	18	Fair
·25	4	Showery
·20	6	Cloudy
·20	20	Cloudy

meter's height is taken at noon.

XXXIX. *Examination of different Processes for obtaining the Separation of Nickel from Cobalt. By* CHRISTIAN FREDERIC BUCHOLZ*.

THE want of pure nickel and oxide of cobalt determined me, for the sake of obtaining it, not only to make experiments of my own invention, but also to repeat different processes proposed for the same object. As it happens but too frequently that some accidental circumstances in experiments are omitted by their authors, or that we are unable, from ignorance of certain indicative characters, to employ the most scrupulous exactness in examining the products obtained,—a circumstance which makes the process we follow give evidence of its own insufficiency,—it will be agreeable to chemists to find here an abridged explanation of my experiments on this matter: the results they have yielded me, added to those which the labours of other chemists have afforded them, will point out the most convenient way to the end proposed, while they save unfruitful trouble and expense.

A. The able chemist Hermstadt had proposed for making the separation of oxide of cobalt from the oxide of nickel, a method which consists in dissolving in ammonia the nitrate or the sulphate of cobalt impregnated with nickel, and to expose the solution to a single evaporation. I proposed to try this process with the contrary design.

1. An ounce of ore of earthy cobalt was therefore dissolved by heat in four ounces of nitric acid of the specific gravity of 1·220, in which had been put an equal quantity of water, which gave in residue three gros of oxide of arsenic under the form of little crystals. The solution, diluted with a portion of water, was of a dingey green colour. It was filtered, and diluted with a greater quantity of water, and a little oxide of bismuth was separated. Caustic ammonia was added in excess until it made no more sensible solution in the obtained precipitate. That which was not dissolved, being of a reddish white, was a composite of the arseniate of cobalt with a little oxide of bismuth and oxide of iron. The filtered solution, which was of a beautiful blue, was evaporated in a gentle heat, by which means about two gros of a beautiful clear green matter was deposited, which on examination was found to be an oxide of nickel

---

* From the *New Universal Journal of Chemistry* of Messrs. Bucholz, Crell, &c., vol. iii.

f cobalt. The filtered liquor,
porated by the heat of a stove,
f the same quality. The saline
ated nickel, of a deep green co-
ined by evaporation, was redis-
n ebullition with an excess of
onia was completely evaporated.
ll separated a gros and a half of
did not appear to contain any
de of cobalt.

s not effected very perfectly or
mentioned, I made trial of sul-
I poured an equal quantity of
obtained, and I added sulphuric
he whole was dissolved. There
very evident manner, an odour
d muriatic acid, although there
uriatic acid employed. I have
phænomenon on a similar occa-
erwards treated with ammonia,
most all redissolved: the residue,
of cobalt with a little oxide of
digris. When the solution had
le heat, and was separated by
d powder, of which the greater
t was left to a spontaneous eva-
ithout any other separation, in
, partly of a pale green, and in
the edges. A trial of the oxides
e solution of these crystals, as
uors, made it obvious that they
in the same proportion.

e result was unsuccessful, I re-
mmence the same experiment
ing that the separation might
tion. In consequence, the oxide
nate of potash from a solution
earthy cobalt in common nitric
e evaporated and filtered), this
nt excess of potash to separate
, the arsenic acid which might
issolved in the sulphuric acid
water. Some pure ammonia
as to dissolve what was soluble
red solution was evaporated by
afterwards left to spontaneous
evaporation.

evaporation. After having parted with a little cobalt mixed with nickel of a pale green, the saline part collected itself, by little and little, into crystals of a blueish green, which could here and there be perceived to be prisms, to which, in different points, were attached some small crystals of calcareous sulphate. To free, as much as possible, these crystals from the adhering mother liquor, they were washed with distilled water, and dried between leaves of blotting-paper. Although the remainder of the lixivium showed no disposition to deposit other regular crystals, I was not able to recognise any difference between the metal which it contained and that in the crystals: it was in both an oxide of nickel mixed with cobalt. The crystals, which weighed five half-ounces, were redissolved in 32 ounces of boiling water; the solution was evaporated to the formation of a thin pellicle, and, after having been filtered, it was put in the vicinity of a stove, to cool slowly and to crystallize. At the end of 48 hours the greater part of the salt was crystallized in beautiful tetraëdral and rhomboidal pyramids, short, and of a yellow green, of which the lateral surfaces formed an angle of 115 and 65 degrees, often with a truncated extremity, and always with an angle of 132 degrees of inclination towards the terminal surface. This result proves that the salt can more easily be formed in regular crystals by refrigeration than by slow evaporation. All these collected crystals having been washed with water were redissolved, and the separation of the oxide of nickel was effected by boiling it with carbonate of potash till the ammonia was disengaged.

4. As much for the sake of having this oxide free from carbonic acid, as for judging if it was purged of cobalt, I dissolved it in nitric acid, and treated it afterwards with pure ammonia, in the manner which has been often mentioned. I evaporated to dryness the beautiful blue liquor which had been freed by filtration from a residue of five grains, which showed itself to be an impure oxide of cobalt. After a subsequent solution there was deposited an oxide of a beautiful clear green, which, after being washed and dried, weighed a half-ounce. The liquor which passed through the filter was analysed by carbonate of potash at a heat of boiling water, which still gave 170 grains of oxide of nickel containing carbonic acid of a pale green. I dissolved a little of it in muriatic acid, and applied the solution to paper. On heating it afterwards, the stains became yellow, inclining only a little towards green. But when the oxide of nickel, which had been separated from the same during evapora-

tion,

aging much of the oxygenated
ead upon paper, and warmed, it
pathetic ink well saturated with
lows that it was more rich in
y precipitation.
different manner, were dissolved
c acids after becoming gray. I
because the oxide of the nickel
lissolved, and because the oxide
he most part, the last remain-
s not confirmed by the experi-
t. When exposed to a low red
heir colour into a blackish gray,
ase by the addition of sulphuric
e residuum by evaporation of the
o separated from it by the addi-
In other respects it acted with
ner that has already been men-

sult of what has been so far

e nitrates of ammoniacal nickel
alt contain always some cobalt
s impossible by the process of
preceding manner, to have the
ixture of cobalt.
ing the nitrate of ammoniacal
e is obtained an oxide of nickel
ontains nitric acid, and the oxide
in this salt not yet decomposed
ity of cobalt.
shown (*Journal de Pharmacie*,
. 2. p. 66.) a process for ob-
nickel; that is, to dissolve the
cobalt, or its oxide already dis-
ces, in nitric acid, to precipitate
nd to expose it to a white heat
In this manner he always ob-
which he afterwards boiled sul-
g, which gave him a solution of
een, while the oxide of cobalt
um under a yellow colour. He
phate of nickel prepared in this
ammonia had to precipitate it
l, when added in excess, to re-
k blue colour. This argument
will

will appear insufficient to those who know that the oxide of nickel, mixed even with many hundred times its weight of cobalt, does not experience any sensible change of colour in its precipitations, nor in its solutions with ammonia; and besides, he has not pointed out the means by which he was convinced that the oxide obtained in the residuum of the solution in the sulphuric acid was an oxide of cobalt. The vague precept, to heat the oxide obtained, without giving the least information on the degree of heat; the uncertainty in which he leaves us respecting the sulphuric acid of which he made use; all these circumstances throw upon the exactness of the indicated process a doubt which the following experiments alone will be able to clear up.

1. A portion of oxide of carbonic nickel A, was exposed, during an hour, to a violent fire nearly of a white heat. The oxide, when yet warm, was brownish yellow. After cooling it took a gray colour inclining to yellow, but not entirely so. The oxide of nickel obtained by the evaporation A 4, having been treated in the same manner, was yet a little more gray than the preceding. The oxide of carbonic nickel was again exposed, for half an hour more, to a white heat: while hot it was yellow inclining to brownish, but when cold it was gray inclining to a brownish yellow.

2. Thirty grains of this torrified oxide were kept some hours in digestion with ninety grains of pure sulphuric acid of the specific gravity of 1·860. Having been afterwards heated, the mass swelled up with a noisy ebullition, and presented a yellow substance inclining to green. By ebullition with a half-ounce of water it was dissolved, leaving nearly a grain of powder of a gray yellow, which proved to be oxide of nickel mixed with cobalt, and a little impurity. I obtained exactly the same result, with the same appearances, in treating a second time in the same manner, and with 90 grains of concentrated sulphuric acid, 35 grains of oxide of nickel, which I had obtained by heating briskly, even to redness, 60 grains of nitrate of ammoniacal nickel prepared by evaporation. By heating the same oxide to whiteness, in a fire urged with bellows, for half an hour, I did not obtain a yellow mass, but one of yellowish gray, inclining a little to green, which acted with the sulphuric acid, as I have formerly stated.

3. I repeated afterwards the same experiment with sulphuric acid weakened. 160 grains of oxide of carbonic nickel were exposed, during a half-hour, to a very violent white heat; after which they still weighed 75 grains. This

substance

yellow here and there, and of
f contact with the crucible. On
wder of a black gray. It was
uric acid diluted with five gros
t ebullition water was added,
nted clear. The residue was
ic acid. There was instantly
gas, and by afterwards heating
idently the odour of hydrogen
ition water was added, and the
The residue was treated anew
This gave then ten grains of a
oxide of cobalt, but an oxide of
as the solution proved in the

ions were each a part analysed
cipitate was besides heated with
wards washed and dried. On
s discovered cobalt, which was
f the first solution; for the so-
pplied on paper and heated, in-
ile the precipitate of the second
a clear and pure green. It is
itate of the former solution has
muriatic acid than that of the

, and some others like them, of
ove:
, weakly or violently warmed,
our; and that if this colour has
ubert, it must depend either on
ents which entered the compo-
aps upon a mixture of a little

he aid of the process of Mr.
of nickel exempt from cobalt,
asion a separation of the two
sensible to the eye.
several experiments which I
e and exact method to produce
have not conducted me to the
me with any other interesting
d chiefly to point out an acid
ides formed an insoluble salt,
ily dissolved. It only remained
for

for me, therefore, to return to the process already pointed out, A, which consists in a partial decomposition of nitrate of ammoniacal nickel: for that which has been proposed by Lehman, to melt the nickel mixed with cobalt from fifteen to twenty times, to a commencement of vitrification, for the purpose of scorifying all the cobalt; as well as that pointed out by Bergman, to repeat the melting three or four times with eight or twelve times as much of pure nitre, was too troublesome and expensive. In consequence, I repeatedly treated the oxide of nickel, which by means of carbonate of potash had been separated from the triple salt not dissolved by the former evaporation, in such a manner that, after having dissolved it by nitric acid, I had recourse to ammonia and to evaporation, as explained above.

It is thus that I finally obtained, entirely exempt from cobalt, the oxide separated by potash from the triple salt which had been redissolved after evaporation.

The oxide which was separated by the evaporation of the nitrate of ammoniacal nickel was in the former operation already entirely purged of cobalt; only it still contained, as has been observed, a little nitric acid. Oxide of nickel, which, after having been reduced to a state of nakedness by evaporation, contains still some cobalt, is naturally susceptible of undergoing anew the same operation.

By this method we may be served with the article in question, until our further discoveries have shown us one more expeditious. It does not occasion any considerable expense; for by means of potash we may effect, in a retort, the evaporation of nitrate of ammoniacal nickel, the same as the subsequent decomposition of the triple salt, and thus save the ammonia for other uses. As is the case in works on a great scale, we can also save a part of the nitrate from the former operation by the evaporation of the water used in washing it.

XL. *An experimental Inquiry into the Nature of Gravelly and Calculous Concretions in the Human Subject; and the Effects of Alkaline and Acid Substances on them, in and out of the Body.* By THOMAS EGAN, *M.D. M.R.I.A.*[*]

THE constant occurrence of these afflicting complaints in Simpson's Gouty Hospital, to which I have been physician for several years, first turned my serious attention to the

---

[*] From *Transactions of the Royal Irish Academy.*

viating or removing them. But,
an examination into the nature
ximate causes; of the chemical
elly matter itself; and that spe-
lly resulting from its aggrega-
edies, and their mode of opera-
necessary. I must also ac-
little excited to this inquiry by
st the medicines now most com-
oners are supposed to exert no
out of the body, yet their be-
nally, stand uncontroverted by
ery physician.

es, I had, as far back as the
ies of experiments in hopes of
on this subject; and, perhaps,
what ground alkaline substances
acids as constantly aggravate,

rs. Fourcroy and Vauquelin had
icularly engaged in the analysis
ncretions; and expecting, from
researches of this kind, that the
y would be more satisfactorily
intrude any observations of my

nxiously attending to the result
this subject, as they have been,
ely detailed, by M. Fourcroy, in
emoirs of the National Institute,
nd elaborate work the *Connois-*
ing little, if indeed any things
to which I would wish to point
as well as the public in general,
ith much care, my experiment,
nore, which may probably prove
int of view.

rvations, and deductions from
ence, offer to the candour and
y.

t the limits of an academic dis-
me chiefly to the consideration
d that species of calculus which
its aggregation.

ntrude as little as possible on
uotation from antient authors,
who

who could have no clear ideas of the subject; yet the better illustration of my object, as well as a sense of justice, oblige me to go as far back as Van Helmont, whose great though eccentric genius first observed that the subject matter of calculus existed in the urine itself. But the flighty extravagance of his ideas, of which he has given us a specimen on this subject in his *Treatise de Lithiasi*, (a wonderful production for the time,) caused little attention to be paid to his opinion; and it was reserved for the capacious and learned genius of Boerhaave first to ascertain, beyond future doubt, the presence of gravelly matter as a natural constituent part of urine, kept in chemical solution in it, and eliminated by it out of the system. Of this important fact no material use was made, until the all-prying genius of the immortal Linnæus induced him to request his friend Scheele to turn, for a moment, his great chemical abilities to the investigation of this subject: with what success is but too well known. And from this again had arisen the further prosecution of this inquiry by the celebrated Bergman.

The result of the analysis of the latter was highly honourable to the former chemist, as they perfectly agreed in almost every particular, with the exception of some small quantity of insoluble matter, and the presence of lime, observed by Bergman: a difference now very easily accounted for; the former having examined calculi of the pure lithic acid, or, as it is now termed, uric kind, (by far the most common species,) and entirely soluble in pure alkaline lixivia and nitric acid; the latter, those of the mixed kind, consisting also chiefly of lithic acid, but with interposed laminæ; or probably a nucleus of either calcareous phosphate or oxalate of lime, which frequently occurs in a very large proportion of these concretions. We may also observe, that Bergman had not, at this period, an adequate idea of the large proportion and insolubility of animal matter contained in them.

From their joint analysis it was, for the first time, proved that the subject matter of gravel, and of a very large proportion of calculi, was present in a state of real chemical solution in all healthy urine; that it was possessed of the following distinguishing chemical properties:

Insipid, inodorous, crystallizable, nearly insoluble in cold water, and only soluble in some thousand times its weight of boiling water; separable again from this, upon cooling, in a beautiful and peculiar crystalline form; of easy solubility in pure alkaline lixivia, which it renders sweetish, and neutralizes; precipitable from these again by the weakest

ossessing its original crystalline
, from these circumstances, with
ble blues red, it was of an acid
acid with effervescence: this so-
d other animal matters red, and,
ess, assuming a red rose colour:
uliarly characteristic of this sub-
by distillation, without any al-
and affording carbonate of am-
nimal products, partly from the
er, and probably some adhering
shing chemical properties of the
y has since added the following:
xivium of either of the fixed al-
f a saponaceous consistence, very
li, but little so without it. The
and soda are little sapid, soluble,
ipitating their dilute solution by
e lithic acid in brilliant needle-
ous, a little coloured, tending to
calls it. Ammonia exerts little,
it: lime water takes up a little.
ave no action upon it: and this
d beg leave to observe, has con-
o this day; but how far founded,
To this matter Scheele gave the
hich it continued to be known,
r. Pearson, has latterly proposed
edily adopted by the French che-
ticularly indicative of its origin.
philosophers of both nations, I
ric acid, and the concretions of
uric acid kind. The publication
the experimental inquiries of both
His experiments were, accord-
of our countrymen in particular;
any instances different, results.
observed, that Bergman's analysis
some circumstances, which he,
sposed to attribute to a difference
uli which they respectively exa-
e has been fully established by
ince that time. We accordingly
son's, in the London Medical
1769, showing these concretions
opposite kinds, and, of course,
soluble

soluble in very different and opposite kinds of menstrua: as also a letter from Dr. Saunders to Dr. Percival, of Manchester, published in the third volume of Percival's Philosophical and Experimental Essays, in 1776, detailing several experiments; from which he fairly concludes that the doctor's enthusiastic hope, of dissolving all calculi in a solution of carbonic acid, must prove groundless, from the very different nature of their component parts, as ascertained by his own experiments. This was placed beyond further doubt by our own learned and ingenious professor Mr. William Higgins, who, in an analysis of a calculus, of which he gives an account in his Comparative View of the Phlogistic and Antiphlogistic Theories, (a work of singular merit for that period, to which we will afterwards refer,) and published so far back as 1789, enumerates the many various substances contained in one specimen only. The researches of Austin, Lane, and Brugnatelli, led to similar results. But to the learned and accurate Dr. Wollaston we stand indebted for the first clear and distinct discrimination of the component parts of these substances. In a paper read to the Royal Society in the year 1797, which would not discredit either a Bergman or a Klaproth, he has most accurately demonstrated, both analytically and synthetically, the component parts of three distinct species of calculi; namely, the fusible, as he terms it, or the ammoniaco-magnesian phosphate of Fourcroy; the mulberry, or oxalate of lime kind; and bone earth calculus, or phosphate of lime, which, with the uric, well known to us since the time of Scheele, left us then acquainted with the four species of calculi of most frequent occurrence. Under these circumstances I cannot help expressing my surprise at finding M. Fourcroy still assuming the merit of the discovery of all the different component parts of calculi, the uric acid and phosphate of lime excepted. This circumstance must appear the more unaccountable, when we consider that the communication of Dr. Wollaston's experiments was through the medium of the Transactions of the Royal Society for 1797. Finally, M. Fourcroy, to whom Europe stands not a little indebted for the present general diffusion of chemical knowledge, and to whom the medical profession owe the greatest obligations for his unremitted application to animal chemistry, has, in conjunction with Vauquelin, given us the result of his researches upon five hundred calculi; from which it appears that they contain the seven following ingredients:

1. Uric acid.
2. Urate of ammonia.

3. Phosphate of lime.
4. Ammoniaco-magnesian phosphate.
5. Oxalate of lime.
6. Silica.
7. Animal matter.

From the prevalence of any of these ingredients, or their relative proportions, he divides them into four genera; and these again into twelve species: for an account of which I must refer to the tenth volume of the *Connoissances Chimiques*, and the Memoirs of the National Institute; not proposing to go into their chemical properties further than may be necessary to my present inquiry; namely, of how far acids may be conducive to the formation, or alkalescent substances to the prevention, or even solution, of a large proportion of gravelly and calculous concretions. We have already remarked, that to the sagacity of Boerhaave we are indebted for the knowledge of gravelly matter being a constituent part of urine kept in chemical solution in it; and, happily for mankind, only separable from it after being some considerable time out of the body. After minutely detailing the ingenious means made use of by Boerhaave to ascertain this important point, to which I beg leave to refer, his commentator, Van Swieten, goes on to observe:

"Hoc calculi rudimenta adsunt etiam in urina hominum sanissimorum; quæ, si una cum urina secernuntur, antequam ab urina secesserint, et concrescere inceperint, nullo modo sanitatem lædent. Cum autem observatum fuerit, illam separationem rudimentorum calculi citius fieri in quibusdam hominibus, tardius in aliis, patet, illos magis calculo obnoxios vivere, in quibus citius hæc separatio arenularum obtinet. An quandoque illa separatio contingit jam in renibus, et in vesica, antequam urina expellatur de corpore? Certe videtur. Vidi sæpius, una cum urina excretum sabulum nephriticum expulsum fuisse, statimque, calente adhuc et fumante urina, in fundo matulæ subsedisse. Contigit aliquoties, inventam fuisse, in linteis sanorum infantum urina madidis, copiam sabuli nephritici, satis duri, quod videtur una cum urina excretum fuisse. Cum enim magna cura haberetur, ne hi infantes, (illustri genere nati,) diutius urinâ, vel aliis sordibus, conspurcati manerent, et urina statim per lintea penetret, vix videtur possibile fuisse, ut in urina jam emissa hoc sabulum productum fuerit, intra unam alteramve horum."

And again he adds: "Hoc sabulum, in urina etiam sanissima concrescens, vocari posset calculus nativus; a quo nemo liber est; at qui tunc tantum metuendus videtur, si cito in urina concrescat. Felices illi, in quibus tardissime hoc fit. Propriam sæpius examinavi urinam, lætusque vidi, rudimenta illa prima calculi separari quam tardissime, requiri quandoque horas viginti quatuor et ultra, antequam in sabulum majoris molis concrescere potuerint. Sed et, licet decimum tertium ætatis lustrum emensus jam fuerim, ab omni lithiasi immunis vixi."

The mode and appearances attending the separation and crystallization of this substance from healthy urine, is one of the most beautiful that, probably, chemisiry affords. But, as the circumstances are so minutely and correctly detailed by Boerhaave, and his commentator, Van Swieten, in his treatise *De Calculo*, vol. v. p. 201 and 202, and correspond so much with my own experiments, so often repeated, I must refer to him. On this passage, however, I must observe, that the space of twenty-four hours, mentioned by him as the period of spontaneous separation, is by far, in the healthy state, too short, and that it extends to two, three, and sometimes more days, according to the existing temperature and other circumstances. Nothing, therefore, I will presume to say, is more erroneous than the assertion, repeated in almost every chemical book, that the uric acid separates from urine upon cooling. When this occurs, which frequently happens, particularly with children, the urine is certainly surcharged with this very insoluble substance.

An increased temperature hastens the incipient decomposition of urine, and its first ammoniacal degeneration is always attended by the deposition of its uric acid in its crystalline form.

This did not escape the observation of Hales, who tells us, that urine, tending to putrefaction, affords most of this acid substance; and, indeed, were it to be deposited upon cooling, or within the space of twenty-four hours, or even more, as is so generally asserted, it should every day present itself to physicians, who so constantly attend to the state of urine in glasses; but this is by no means the case: and we find Fourcroy, in his last publication, mentioning from twenty-four to forty-eight hours, which certainly only applies to summer heat, or the circumstance already mentioned.

Our next great obligation is, undoubtedly, to Scheele, who has made us acquainted with its nature, and the very distinct chemical properties already enumerated.

While in the state of gravel it is ever the same, whether passed

the urine, or spontaneously de-
m it; a circumstance that, for a
ve me much surprise, consider-
but of the truth of which I was
ation of many hundred speci-
s.

o find, that Fourcroy, for the first
Chimiques, asserts, " les sables
ours de l'acide urique." And in
king of the uric acid, " c'est lui
e crystallize, et s'attache aux par-

calculi of this kind should be of
; and that, of five hundred ana-
urth should entirely consist of it,
ixture with the remainder; and
d by Pearson, the greater number
ature.

necessary observations, we have
ircumstances we may attribute its
d or aggregate state, from its na-
ondition in which it can be pro-
, or diseases of this kind. And
it, being a natural secretion, of
ne vehicle destined to carry it out
e subject to the same derange-
retions of the human body, and
s exceed in quantity, and at other
which last circumstance seems to
inuance of acute diseases.

sed secretion does frequently oc-
ndent of external causes, we have
f of in the hereditary dispositions
omplaint: and, indeed, when we
e place, relative to the functions
, we must not be surprised at si-
of the kidneys. Here, truly,
ous tendency, as, from the very
ic acid, even in its own natural
excess in quantity must subject

necessary considerations, I shall
ose circumstances which the ex-
of all times have pointed out to
casional causes of these maladies,
and

and how far these opinions may be confirmed by experiments instituted for that purpose.

And first, It is a matter of notoriety, that the period of life, from infancy to about fifteen inclusive, is most subject to disorders of this kind.

Of this practical observation we have an interesting confirmation inserted in the second volume of the Memoirs of the French National Institute, Mathematical and Physical Sciences, year 7. Under the former happy regime there was instituted, about forty years ago, at Luneville, in Lorraine, an hospital for the exclusive relief of calculous and gravelly patients. In that interval, 1629, of both sexes, were admitted, and operated upon. Of these, 1564 were males, and only 65 females.

C. Saucerotte, an associate of the Institute, to whom we are indebted for these interesting details, annexes tables indicative of the number of these patients, that occurred at the different periods of life, from the age of one up to seventy-eight. To these, as too extensive to be inserted here, I would beg leave to refer; and shall satisfy myself with some extracts only, expressive of the general result.

Age of Patients. Male Sex.	Number of Patients.
1 year to 2	1
2 years	14
3	79
4	131
5	145
6	147

From this age, which afforded the maximum of the number of patients, we find a gradual declension, as follows:

Age of Patients.	Number of Patients.
8 years	121
10	79
15	39
20	16
25	7
30	8
35	4
50	5
60	2
70	2
78	1

Of

les,

	Number of Patients.
3 - -	1
- - -	8
- - -	7
- - -	4
- - -	6
- - -	5
- - -	3
- - -	4
- - -	1

own to seventy-eight, there occurs
ach year. From these, then, we
bject the male sex is to those com-
and the earlier periods of life, than
or among the males in the sixth
atest number), and among the fe-
From these periods, in both sexes,
nish.

us to conclude that some physio-
the functions of this early stage,
erence; and I will not pretend to
exist: but when we consider that
nt poor are the greatest sufferers,
further, and suspect the existence
ecting and applicable to them all.
in the children of this class of so-
t every where nearly take place, is
but too often, of the kind most
ndency, such as pap, gruel, sour
s not always in the power of the
nister, in a recent and sound state;
occurring from the negligence of
r ranks, but irremediable in the
at tendency cannot be corrected
re of broth, or other light animal
tion confining them exclusively,
le use of vegetables and the fari-

y to the advanced periods of life,
island, we find that, considering
on, the disease is of relative rare
that the late Mr. Dease, (whose
still to deplore, as a national cala-
deserved celebrity as a lithotomist,
e than sixty. A small number,
indeed,

indeed, when we consider that the operation is seldom, if ever, attempted in the country. And why this should happen here, we shall be presently, perhaps, better able to judge.

The reverse of this occurs in the sister kingdom; and the Irish student feels astonished at the frequency of the operation in all the London hospitals, though also performed in those of the more considerable country towns; and, upon inquiry, he finds that a large proportion of these patients come up from the cider counties of Hereford, Devon, &c.: and it must naturally occur to him, that the general use of fermented liquors of every kind, beer, cider, perry, and factitious wines, which prevail in England, renders the disease of more frequent occurrence there than with us, the great mass of our people being deprived of these luxuries.

If we pass over to the Continent, we find our neighbouring provinces, Picardy, Normandy, and Britany, in particular, still more subject to affections of this kind; so much so, that the late Mr. Dease could not give credit to the extraordinary number of patients operated on, in one year only, in the hospital of Rouen; though many must have, of course, repaired to Paris. The same, though in a lesser degree, takes place in Champagne; and it is almost unnecessary to observe, that the general beverage of the northern provinces consists of cider, or of poor wine, equally acescent in its nature, and prone to the acetous fermentation. The Champagne, though somewhat less so, is replete with carbonic acid gas and disengaged tartarous acid; and though, in the more southern provinces, this malady cannot be considered as endemial, yet it is of frequent occurrence in the hospitals of Montpellier.

For, even in these favoured climes, where wine is of so little value, and withal so spirituous, the unfortunate peasant is obliged to content himself with an inferior quality, prepared by a second maceration of the *marc* of the grape, which he denominates *picquet*; a *patois* appellation, most happily applied to its highly acid quality.

In that once happy country, Switzerland, on the contrary, as baron Haller assures us, the disease is by no means frequent, and chiefly confined to the children of the poorer sort; their mountainous and elevated situations affording them little or no vinous liquors; whereas their neighbours, the inhabitants of the Rhine and Moselle, as well as some tracts on the banks of the Danube, are peculiarly afflicted.

The truth of this observation we find confirmed by the medical

es. Silvius observes, "Vina
nagis nocere calculosis quam
particularly insisted on in Do-
merides Naturæ Curiosorum,"
emici," &c. Now, the wines
nown to be of an acid quality:
at too from experiments, that
s acid, having found them to
antity of that in other wines;
small proportion of carbonic
ertation "De Genesi Calculi,"
e of the "Amœnitates Acade-
ilarly to point out acids, and
causes of calculous affections.
centia omnia calculum promo-
si calculi magis favent, quam
piose ingurgitant, podagræ et
uam illi, qui terras calidiores
hauriunt. Nec mirum, cum
destillatione dant spiritus acidi
ocariensis præbet spiritus acidi
Hoffmanno. Sanissimus quis-
nguriam incurrit, eo quod ab
rrestres præcipitantur." And
ur et calculus ab acido gene-
id etiam ab eorum communi
culentius patebit." Beverovic,
s: "In nullo vino tantum tar-
n Rhenano. De me ipso, quod
memini, possum testari, nun-
e paulo largius, quin copiose

observed to take place where
ed. Rivinus observes, that in
he pursuit of commerce brings
of the neighbouring Asiatic na-
occurs, it is almost always in
ander, who, in his passage to
ed beer, and used sour crout.
r, in his excellent treatise *De*
, that whenever calculous af-
pahan or the provinces, it is as-
me Armenian; fellows, (to use
titude, drink more wine than

here the proximity of the Gre-
nveyance by the Nile, render
wine

wine of easy acquisition, and drunkenness and public houses as common as in any city in Germany; we learn, from Prosper Alpinus, that the disease is of very frequent occurrence; for, besides a mixed population of Franks, Armenians, Arabs, &c., the Mamelukes, as well as many other Turks of the higher ranks, do not, in deference to the Mahometan law, refrain from wine. The Cyprian and Grecian wines, if not adulterated, or become acescent by dilution, and the warm temperature of that city, are, in themselves, among the least objectionable. But, when we consider that Paris is chiefly supplied with Burgundy, and that yet in no part of the world does there occur more mischief from the attempts to keep down and correct its acescency, we shall easily form an opinion of the quality of the wine retailed in Cairo.

To this abstinence, then, from wine and fermented liquors; as also, perhaps, to the admixture of a large proportion of the warmest spices in their vegetable food, tending to correct its acescent tendency; we may ascribe the rare occurrence of this disease in the more southern climates.

Now, these more general remarks we find peculiarly to coincide with the observations of the patients themselves, as well as that of the physician; for such as have laboured under these complaints a sufficient length of time to become acquainted with the *juvantia* and *lædentia*, most scrupulously abstain from acids, and acescent drinks of all kinds, and, what they find most particularly pernicious, beer or ales turning over to the acetous fermentation, or *hard*, as they are generally termed. And, indeed, nothing is more common, than that an indulgence in cider, claret, or acidulated punch, nay, a draft of hard beer or porter, should be followed by a fit of the gout and gravel.

The connection between these diseases forms an interesting and curious subject of physiological as well as pathological inquiry; but, proposing to offer some observations on this subject on a future occasion, I shall at present decline entering upon it, and pass on to observe, that the bad effects of all acidulous drinks are fully confirmed by the experience of our many sufferers in Simpson's hospital. Hewson, who lately died there at the advanced age of 102, never tasted the beer of the house during the summer months, and substituted milk for it; being taught by experience, that its acid tendency, during that period, always induced his gravelly paroxysms. And Clapham, who suffered much from gout and gravel, and was for many years

ne his voyages to America were
both ; which he attributed to a
of cider, a beverage to which he
ed : and that, at any time, he
of one or the other, or both,
inch, or claret. Khensk our
l his articulations distorted by
o once lived in easy circum-
e severest and longest protracted
he ever experienced was occa-
poor vapid claret. And I shall
subject by observing, that the
lic church are peculiarly liable
rm no small proportion of the
this city ; which I would attri-
nd sour wine during their resi-
road.

continued.]

---

nication *from* *Dr.* THORNTON,
eumatic Medicine.

r. Tilloch.

Hinde-street, Manchester-square,
November 1, 1805.

ormed by the pneumatic prac-
of medical agency has failed,
umerous, that I am certain the
ll a large volume, so eager have
ource from the *aërial remedies*
se incurable.

ilson, sadler, the subject of the
ases have occurred which yet
the *pneumatic practice.*

d by Vital Air.

n in a declining state of health
k, weak, and debilitated ; and a
on, pronounced to the parents
surviving. The vital air, two
heric, was now tried with tonic
from the very first day that her
roved. In six weeks she was
nce continued well. It is now

Another

Another cured by Vital Air.

Miss Ann Russel, also, niece to Mr. Wilson, a beautiful young lady, æt. 20, fell into a decline, or wasting, which continued for the space of nine months. She was reduced so low as hardly to be able to walk across the room; her bones nearly came through her skin; a total loss of appetite, with dejection of spirits, took place, but no cough. As medicines seemed to have no effect in arresting the progress of this decay, the vital air was had recourse to, which, to the astonishment of all, produced a very speedy cure. The vital air, a gallon per diem, each time of inhaling it diluted with four parts of atmospheric, produced a glow over the whole frame; the appetite returned, the spirits of course were increased, and the young lady gained flesh. It is now eight months, and she has all along continued in perfect health.

Observations on these Cases by Dr. Thornton.

The functions of life often lag, as it were, without disorganization of parts, and this from an impoverished or disoxygenated state of the blood. Tonics only half do their office, unless the vital principle in the blood be increased; and though only inhaled *once a day*, yet if we calculate that the momentum is always going on, and that only one impulse to a wheel in motion accelerates all the movements for a given time, therefore this one impulse in the animated machine has a great effect: thus the stimulus of one or more glasses of wine *once a day* has a diurnal effect, if I may so use the expression, on the animated machine.

I have the honour to remain, dear sir,
Your faithful obedient servant,
ROBERT JOHN THORNTON.

XLII. *On a new Metal recently discovered by M.* TROMSDORFF*.

M. TROMSDORFF received the fossil containing the new metal of M. Counsellor Thon, of Eisenach, who found it in a mass of rock. The fossil was of an iron gray colour, very weighty, and had a scaly fracture, exhibiting, when seen through a magnifying glass, holes and stripes of a deep yellow.

---

* From *Journal de Chimie et de Physique*, tom. v.

t the first view for anthracite:
ve the flame of a lamp for the
its incombustibility; but it in-
with a pale blue flame. Some
rystallized in stars, and were
n. The mineral, when melted
r. On dropping some nitric
ineral, the acid did not appear
ut by the aid of heat it changed
ebullition dissolved it, taking
To assure himself that the mi-
rcury, M. Thon rubbed it on
ommunicated a yellow colour.
the small quantity of the mi-
e to procure, the following ex-

ral were put into a small cylin-
e and exposed to the action of
and spread a very strong sul-

e sides, at the top a white sub-
nate of yellow sulphur, lower
imate, and finally a crystalline
etallic lustre. The whole was
r was put sideways.
sil were exposed to heat with
al acquired a red-brick colour,
ngly, disengaging nitrous acid.
l to dryness, and a powder was
ich emitted a strong smell of
boiled with water, in which it
ly a grain, which had the co-
burnt with the usual flame and

ined some free nitric acid, and
. The redundant acid was sa-
l the solution was decomposed

oduced a beautiful green pre-

mmonia gave a shamoy-yellow

gave a deep-brown precipitate
er some time became blueish

d. Caustic ammonia in excess produced neither precipitate nor change of colour.

These experiments prove that there was no iron, no copper, nor nickel, in the mineral; but its manner of acting with the reagents, to which it was submitted, made M. Tromsdorff suspect the presence of a new metal, which the above experiment demonstrated, and that this metal was combined with sulphur, and was volatile.

4. The shining black sublimate was as well as possible separated from the yellow, and put to digest with nitric acid. It dissolved entirely, disengaging nitrous gas, and formed a clear and colourless solution. M. Tromsdorff then saturated the excess of the acid by liquid ammonia, and successively decomposed it in portions with the above reagents. He obtained the same results as before.

5. Some grains of the fossil were then heated with some nitro-muriatic acid. It dissolved entirely, except a light residue of a reddish yellow colour, which was apparently sulphur in combination with some metallic particles. The solution when filtered was at first clear, but grew turbid on cooling. It was saturated with ammonia, and decomposed by the same reagents as formerly. The results were the same.

6. Some grains of the fossil were put to digest with muriatic acid. It disengaged from it sulphurized hydrogen gas, and the fossil became brownish: however, the acid attacked it but slowly. The remainder of the fossil was put to boil even to dryness with colourless sulphuric acid concentrated, and the residue was diluted with water. It dissolved itself entirely, except a powder almost yellow, which, when collected on the filter, washed and dried, burnt like sulphur.

The solution had a reddish colour, and contained much free acid. It was tried by several reagents.

a. Prussiate of potash produced a green precipitate.

b. Hydro-sulphuret of ammonia produced a shamoy precipitate.

c. Tincture of galls, a blueish gray precipitate.

d. Caustic alkali, a white precipitate.

e. Carbonate of potash, the same precipitate.

7. The two last precipitates remained white when exposed to the air. They dissolved easily in acetic acid, with which they gave a colourless solution, which was divided, and submitted to the following experiments:

a. In a part of the solution was put a small polished piece

of

wenty-four hours the piece was
ow crust, which, when rubbed
olour of shining iron.
ining part into three portions,
prussiate of potash, hydro-sul-
tincture of galls : exactly the
as in the preceding trials with

ese experiments his supply of
s obliged to state his researches.
esults, that the fossil forms a
h a new metal. But he says he
with rigorous certainty. It is
tains a metal, as much by its
reagents, as by its precipitation
ic aspect of the substance which
And it is not doubtful that it
e can really separate this sub-

ved that this metal is volatile,
idue on the fire. We know no
e but mercury, bismuth, arsenic,
metal in question cannot be
fluid form, this metal produces
with sulphur, of which it has
iscover the slightest trace. It
s less volatile, and of which the
ed by the prussiate of potash of
dro-sulphuret of ammonia of a
by galls of a yellow greenish
nic, or that would have dis-
and which besides would not
ena observed. Still less can it
ery strong heat to volatilize it,
reagents employed by our au-
olours, and which, instead of
per, does itself precipitate that
s precipitated of a white colour
orange by hydro-sulphuret of
in sulphuric acid is not at all
tal. M. Tromsdorff concludes
he has examined is in all pro-
sulphur with a metal hitherto

XLIII. *On*

XLIII. *On muscular Motion.* *By* ANTHONY CARLISLE, *Esq. F.R.S.: being the Croonian Lecture. Read before the Royal Society November* 8, 1804.

[Concluded from p. 123.]

THE following animals were put into separate glass vessels, each filled with a pound weight of distilled water, previously boiled to expel the air, and the vessels inverted into quicksilver; viz. one gold fish, one frog, two leeches, and one fresh water muscle*. These animals were confined for several days, and exposed in the sun in the day-time, during the month of January, the temperature being from 43° to 48°; but no air bubbles were produced in the vessels, nor any sensible diminution of the water. The frog died on the third day, the fish on the fifth, the leeches on the eighth, and the fresh water muscle on the thirteenth. This unsuccessful experiment was made with the hope of ascertaining the changes produced in water by the respiration of aquatic animals, but the water had not undergone any chemical alteration.

Animals of the class mammalia, which hybernate, and become torpid in the winter, have at all times a power of subsisting under a confined respiration, which would destroy other animals not having this peculiar habit. In all the hybernating mammalia there is a peculiar structure of the heart, and its principal veins: the superior cava divides into two trunks; the left, passing over the left auricle of the heart, opens into the inferior part of the right auricle, near to the entrance of the vena cava inferior. The veins usually called azygos accumulate into two trunks, which open each into the branch of the vena cava superior, on its own side of the thorax. The intercostal arteries and veins in these animals are unusually large.

This tribe of quadrupeds have the habit of rolling up their bodies into the form of a ball during ordinary sleep, and they invariably assume the same attitude when in the torpid state: the limbs are all folded into the hollow made by the bending of the body; the clavicles, or first ribs, and the sternum, are pressed against the fore part of the neck, so as to interrupt the flow of blood which supplies the head, and to compress the trachea: the abdominal viscera and the hinder limbs are pushed against the diaphragm, so as to interrupt its motions, and to impede the flow of blood through the large vessels which penetrate it, and the longitudinal

---

* *Mytilus anatinus.*

cavity of the thorax is entirely
ned circulation of the blood is
art, probably adapted to the last
its gradual recommencement.
ion is the first step into the state
accompanies it; respiration then
imal temperature is totally de-
nsibility take place; and finally,
otions, and the muscles cease to
of remark, that a confined air,
ever precede these phænomena:
e open atmosphere, his mouth
into contact with his chest, and
s become rigid, but the blood
the dormant state. On being
, the respirations are fluttering,
irregularly, he begins to stretch
s in quest of food. During this
be frozen without the destruc-
bility; and this always happens
o the chrysalides of many insects
limate.

l sensation from the influence of
y each other, and the capillaries
ear to become contracted by the
the examples of numbness from
ion of muscular action be owing
f the nerves, or to the lowered
themselves, is doubtful; but the
pon the sensorial system, rather
t a certain temperature is neces-
of nervous influence as well as

s require a longer time in drown-
rown hedge-hog was submersed
retained there: air bubbles be-
d continued during four minutes:
ious for its liberty. After seven
about, attempting to escape; at
up, only protruding the snout,
ed on being touched with the
ach of the finger caused it to re-
es complete submersion, the ani-
, and withdrew its nose on being

---

lix nemoralis.

touched. After remaining thirty minutes under water, the animal was laid upon flannel, in an atmosphere of 62°, with its head inclined downwards; it soon began to relax the sphincter muscle which contracts the skin, slow respirations commenced, and it recovered entirely, without artificial aid, after two hours. Another hedge-hog, submersed in water at 94°, remained quiet until after five minutes; about the eighth minute it stretched itself out, and expired at the tenth. It remained relaxed and extended after the cessation of the vital functions; and its muscles were relaxed, contrary to those of the animal drowned in the colder water.

The irritability of the heart is inseparably connected with respiration. Whenever the inhaled gas differs in its properties from the common atmosphere, the muscular and sensible parts of the system exhibit the change; the actions of the heart are altered or suspended, and the whole muscular and sensorial systems partake of the disorder: the temperature of animals, as before intimated, seems altogether dependent on the respiratory functions, although it still remains uncertain in what manner this is effected.

The blood appears to be the medium of conveying heat to the different parts of the body; and the changes of animal temperature in the same individual at various times, or in its several parts, are always connected with the degree of rapidity of the circulation. It is no very wide stretch of physiological deduction to infer, that this increased temperature is produced by the more frequent exposure of the mass of blood to the respiratory influence, and the short time allowed in each circuit for the loss of the acquired heat.

The blood of an animal is usually coagulated immediately after death, and the muscles are contracted; but in some peculiar modes of death, neither the one nor the other of these effects is produced: with such exceptions, the two phænomena are concomitant.

A preternatural increase of animal heat delays the coagulation of the blood, and the last contractions of the muscles: these contractions gradually disappear before any changes from putrefaction are manifested; but the cup in the coagulum of blood does not relax in the same manner; hence it may be inferred that the final contraction of muscles is not the coagulation of the blood contained in them; neither is it a change in the reticular membrane, nor in the blood-vessels, because such contractions are not general throughout those substances. The coagulation of the blood is

ath. The reiterated visitations of
muscular irritability, because the
ed from the body, continue for a
able of contractions and relaxa-

tary materials of which the pecu-
substances consist, are not sepa-
cesses hitherto instituted, in such
recombination into their former
f these substances appears to be
ation, and the attractions of the
h form the gross substances are
t they are all decomposed without
ent, merely by the operation of
s on each other.
n of the chemical properties at-
uscle would be a labour unsuited
not, however, discharge my pre-
o say that all such investigations
en effected by simple processes,
aw materials of the animal fabric,
men of eggs, and the blood. But
riments, the peculiar substances
from what are considered to be
he changes of organic secretion
be hoped that any determinate
lished upon which the physiology
ed. Such researches and inves-
, the most probable ultimate suc-
na are nearest allied to those of
other hypotheses have, in their
ry.

ding to support and illustrate the
ng Argument.

s killed by dividing the medulla
od-vessels under the first bone of

flowing blood was	103°
Spleen -	103
Stomach -	101
Colon -	98
Bladder of urine	97
Atmosphere -	30

a blow on the head, and by the
large arteries and veins, entering
the

the middle of the basis of the heart, had the blood flowing from these vessels of 106, 106½, and 107°; the atmospheric temperature being at 31°.

An ox, killed in a similar manner, the blood 103°; atmosphere 50°.

Three sheep, killed by dividing the carotid arteries, and internal jugular veins: their blood 105, 105, 105½°; atmosphere 41°.

Three frogs, kept for many days in an equable atmosphere at 54°; their stomachs 62°.

The watery fluid issuing from a person tapped for dropsy of the belly 101°; the atmosphere being 43°, and the temperature of the superficies of the body at 96°.

These temperatures are considerably higher than the common estimation.

A man's arm being introduced within a glass cylinder, it was duly closed at the end which embraced the head of the humerus; the vessel being inverted, water at 97° was poured in, so as to fill it. A ground brass plate closed the lower aperture, and a barometer tube communicated with the water at the bottom of the cylinder. This apparatus, including the arm, was again inverted, so that the barometer tube became a gage, and no air was suffered to remain in the apparatus. On the slightest action with the muscles of the hand, or fore-arm, the water ascended rapidly in the gage, making librations of six and eight inches length in the barometer tube on each contraction and relaxation of the muscles.

The remarkable effects of crimping fish by immersion in water, after the usual signs of life have disappeared, are worthy of attention; and whenever the rigid contractions of death have not taken place, this process may be practised with success. The sea fish destined for crimping are usually struck on the head when caught, which, it is said, protracts the term of this capability; and the muscles which retain this property longest are those about the head. Many transverse sections of the muscles being made, and the fish immersed in cold water, the contractions called crimping take place in about five minutes; but, if the mass be large, it often requires thirty minutes to complete the process.

Two flounders, each weighing 1926 grains, the one being in a state for crimping, the other dead and rigid, were put into water at 48°, each being equally scored with a knife. After half an hour the crimped fish had gained in weight 53 grains,

h had lost 7 grains. The specific
was greater than that of the dead
r bubbles adhered to the surfaces
which were rubbed off before
t inflammable.
he crimped fish - 1·105
the dead fish, after an
ual immersion in water 1·090
f water, specifically lighter than
t diminish the specific gravity of
contrary: a proof that condensa-

eighing twelve pounds, gained in
ounces avoirdupois; and another
fteen pounds, gained one ounce

g, having the skin stripped off,
, was immersed in water at 54°,
eteen hours, when it had become
grains. The specific gravity of
creased, as in the crimped fish.
e subscapularis muscle of a calf,
o days from the 10th of January,
iver water at 45°. After ninety
contracted, and weighed in air
ncreased in specific gravity, but
formed in the interstitial spaces
made it difficult to ascertain the

ciculi of muscular fibres from the
t been immersed in water, were
n the field of a powerful micro-
r thrown over them, at the tem-
osphere in the room being 57°.
ontract, and became tortuous.
f another fibril with little weights
-thirds of its former length, by
ame experiment was made on the
nd beef, twelve hours after the
ith the like results. Neither vi-

---

nping of fresh water fishes requires hard
he purposes of washing with soap. This
e of the London fishmongers, whose ex-
y pump water, or what is commonly called

negar, nor water saturated with muriate of soda, nor strong ardent spirit, nor olive oil, had any such effect upon the muscular fibres.

The amphibia, and coleopterous insects, become torpid at 34°: at 36° they move slowly, and with difficulty; and at a lower temperature their muscles cease to be irritable. The muscles of warm-blooded animals are similarly affected by cold.

The hinder limbs of a frog were skinned, and exposed to cold at 30°, and the muscles were kept frozen for eight hours; but on thawing them they were perfectly irritable.

The same process was employed in the temperature of 20°, and the muscles kept frozen for twelve hours; but that did not destroy the irritability.

In the heat of 100°, the muscles of cold-blooded animals fall into the contractions of death; and at 110°, all those of warm blood, as far as these experiments have been extended. The muscles of warm-blooded animals, which always contain more red particles in their substance than those of cold blood, are soon deprived of their irritability, even although their relative temperatures are preserved; and respiration in the former tribe is more essential to life than in the latter.

Many substances accelerate the cessation of irritability in muscles when applied to their naked fibrils, such as all the narcotic vegetable poisons, muriate of soda, and the bile of animals; but they do not produce any other apparent change in muscles than that of the last contraction. Discharges of electricity passed through muscles, destroy their irritability, but leave them apparently inflated with small bubbles of gas; perhaps some combination obtains which decomposes the water.

The four separated limbs of a recent frog were skinned, and immersed in different fluids; viz. No. 1. in a phial containing six ounces, by measure, of a saturated aqueous solution of liver of sulphur made with potash; No. 2. in a diluted acetic acid, consisting of one drachm of concentrated acid to six of water; No. 3. in a diluted alkali, composed of caustic vegetable alkali, one drachm, of water six ounces; No. 4. in pure distilled water.

The phials were all corked, and the temperature of their contents was 46°.

The limb contained in the phial No. 1, after remaining twenty minutes, had acquired a pale red colour, and the muscles were highly irritable.

The limb in No. 2, after the same duration, had become rigid, white, and swollen; it was not at all irritable. By removing

diluted solution of vegetable al-
laxed, but no signs of irritability

former circumstances, retained its
d was irritable, but less so than

id, and the final contraction had

s of muscular irritability occur in
some examples of which may not
sent subject. Workmen whose
posed to the contact of white lead,
l a palsy in the hands and wrists,
uscles of the fore arm. This affec-
local, because, in many instances,
e other members partake of the
affects the right hand. An inge-
in London has frequently expe-
ty in the muscles of his fore arms,
acid over the cuticle of the hand
ercury occasionally brings on a si-
eter muscles.
ood flows through a muscle during
han during the quiescent state, as
ur of red muscles when contracted.
ow of blood from the veins of the
ction, when the muscles of the
he increased flow after alternate
obability, that a temporary retarda-
muscular fibrils takes place during
its free course obtains again during
e of the vascular system in a con-
however, explain the diminution
may have some influence on the

rously contracted, their sensibility
ved: this means is employed by
of suffering pins to be thrust into
other muscular parts, with impu-
nable to expect, *à priori*, that the
tary influence, cannot pass along
ne.
ences already enumerated, the hu-
ble of changes from extraordinary
mpressions. Long continued at-
sible objects, or to audible sensa-
tions,

tions, are known to exhaust the muscular strength: intense thought and anxiety weaken the muscular powers, and the passions of grief and fear produce the same effect suddenly; whilst the contrary feelings, such as the prospect of immediate enjoyment, or moderate hilarity, give more than ordinary vigour.

It is a very remarkable fact in the history of animal nature, that the mental operations may become almost automatic, and, under such habit, be kept in action, without any interval of rest, far beyond the time which the ordinary state of health permits, as in the examples of certain maniacs, who are enabled, without any inconvenience, to exert both mind and body for many days incessantly. The habits of particular modes of labour and exercise are soon acquired, after which the actions become automatic, demand little attention, cease to be irksome, and are affected with little fatigue: by this happy provision of nature, the habit of industry becomes a source of pleasure, and the same appears to be extended to the docile animals which co-operate with man in his labours.

Three classes of muscles are found in the more complicated animals. Those which are constantly governed by the will, or directing power of the mind, are called voluntary muscles. Another class, which operate without the consciousness of the mind, are denominated involuntary: and a mixed kind occur in the example of respiratory muscles, which are governed by the will to a limited extent: nevertheless the exigencies of the animal feelings eventually urge the respiratory movements in despite of the will. These last muscles appear to have become automatic by the continuance of habit.

The uses of voluntary muscles are attained by experience, imitation, and instruction; but some of them are never called into action among Europeans, as the muscles of the external ears, and generally the occipito-frontalis. The purely involuntary muscles are each acted upon by different substances, which appear to be their peculiar stimuli; and these stimuli co-operate with the sensorial influence in producing their contractions: for example, the bile appears to be the appropriate stimulus of the muscular fibres of the alimentary canal below the stomach, because the absence of it renders those passages torpid. The digested aliment, or perhaps the gastric juice in a certain state, excites the stomach. The blood stimulates the heart, light the iris of the eye, and mechanical pressure seems to excite the muscles of the œsophagus. The last cause may perhaps be il-

f compression upon the volun-
contracted, of which there are
robably the muscles of the ossi-
by the tremors of sound; and
the peculiar arrangement ob-
pani which serves those muscles.
seem only to act in conjunction
rived by those muscles from the
the passions of the mind alter
heart, the alimentary canal, the
iris; so that, probably, the re-
merated, only act subserviently,
of the sensorial power, (if that
) and thereby calling forth the
from the peculiar organization
thetic nerves, is effected without
he attention of the mind, or the
revail, all the involuntary mus-
steadily, or wholly cease. The
he common parrot are a striking
ence.
r tribes of animals, which are
nerves coming from ganglions,
hus the animal motions are prin-
ernal stimuli, of which the oc-
ith the animal necessities: but
which comparative anatomy af-
ch too copious for any detail in

uscles; one active, which is that
a state of ordinary tone, or re-
nsidered passive, as far as it re-
sensorial or nervous power seems
it respects either the voluntary
ring life. The yielding of the
d on their being overpowered by
than on voluntary relaxation, as

s endeavour to exhibit the more
ected with muscular motion.
ry one, that much remains to be
theory can be proposed. I have
of others without acknowledg-
tedious to trace every fact, and
authority; many of the views
elf, and I have adduced many
general

general assumptions and conclusions, without offering the particular evidence for their confirmation, from a desire to keep in view the remembrance of retrospective accounts, and to combine them with intimations for future research. The due cultivation of this interesting pursuit cannot fail to elucidate many of the phænomena in question, to remove premature and ill-founded physiological opinions, and eventually to aid in rendering the medical art more beneficial, by establishing its doctrines on more extensive and accurate views of the animal œconomy.

XLIV. *Information on the Mines and Manufactures of the East Indies, and other Subjects.* *By* J. MACHLACHLAN, *Esq. of Calcutta*[*].

SIR,

SHOULD you think the enclosed receipts for dyeing the beautiful reds of the Coromandel coast can be of any use to the dyers of the united British kingdom, be pleased to lay them before the Society for the Encouragement of Arts, &c. that they may be published in the volume of their Transactions; if not, I trust you will excuse my troubling you with them. They were sent to me from Madras by a scientific friend, who had the several operations, detailed in them, performed in his own presence. I forwarded a copy of them; and a small quantity of the ingredients mentioned in them, to a friend at home, several years ago; but he dying about or soon after the time of their arrival, I never learned what became of them. It strikes me, however, that there is a considerable coincidence between the thread process and that which I have seen recommended by Mr. Henry, of Manchester, for dyeing the Adrianople or Turkey red.

I am not certain whether it is known at home, that many of the hills in Bahar, and other parts of India, contain immense quantities of mica, talc, or Muscovy glass. The natives of this country and China make very splendid lanterns, shades, and ornaments of it, tinged of various fanciful colours; and it is also used by them in medicine. When burned or calcined, it is, I am told, considered as a specific in obstinate coughs and consumptions. When powdered it serves to silver the Indian paper, &c. used in letter-

---

[*] From *Transactions of the Society of Arts*, &c. 1804, which voted its silver medal to the author for the communication.

t, it is applied to numberless pur-
f that of the best quality, split
es thick, is six rupees the maund
irdupois. If it could be applied
ome, it might go in part ballast
xpense. I enclose a small speci-

Your very obedient servant,
J. MACHLACHLAN.

dye root of the coast, is, I be-
also the cashan leaves, which

ight Red, four Yards of three-
ad Cotton Cloth.

well washed and dried, for the
lime and congee, or starch, ge-
bleaching and dressing cloths;
ssel, containing twelve ounces
ith a gallon of water, and allow
the fire.
en out, washed in clean water,
in put into a pot with one ounce
rsely powdered, and a gallon of
boil to one half; when cool, add
a pint of buffalo's milk. The
this, take it out, and dry it in

n in clear cold water, and dry it
into a gallon of water, a quar-
lk, and a quarter of an ounce of
well in this mixture, and dry in
his stage of the process, feeling
lled up and beetled till it be-

rts of cold water six ounces of
ow it to remain so two days.
wn to two-thirds the quantity,
of a good bright red colour.
re it cools, add a quarter of an
oak in it your cloth twice over,
in the shade.
h in clean water, and half dry
the cloth into five gallons of
water,

water, at about the temperature of one hundred and twenty degrees of Fahrenheit, adding fifty ounces of powdered chaya, and allowing the whole to boil for three hours; take the pot off the fire, but let the cloth remain in it until the liquor is perfectly cool; then wring it gently, and hang it up in the sun to dry.

6th, Mix intimately together, by hand, about a pint measure of fresh sheep's dung, with a gallon of cold water, in which soak the cloth thoroughly, and immediately take it out, and dry it in the sun.

7th, Wash the cloth well in clean water, and spread it out in the sun on a sand-bank (which in India is universally preferred to a grass-plat) for six hours, sprinkling it from time to time, as it dries, with clean water, for the purpose of finishing and perfecting the colour, which will be of a very fine bright red.

Calcutta, Oct. 4, 1803. J. MACHLACHLAN.

Charles Taylor, Esq.

Directions for dyeing of a beautiful Red, eight Ounces of Cotton Thread.

1st, Put one gallon and a half, by measure, of sap-wood ashes, into an earthen pot, with three gallons of water, and allow the mixture to remain twenty-four hours to perfect it for use.

2d, Put the following articles into an earthen pot, viz. Three-quarters of a pint of Gingelly oil; one pint, by measure, of sheep's dung, intimately mixed by hand in water; two pints of the above ley. After mixing these ingredients well, pour the mixture gradually upon the thread into another vessel, wetting it only as the thread, by being squeezed and rolled about by the hand, imbibes it, continuing to do so until the whole is completely soaked up, and allow the thread to remain in this state until next day.

3d, Take it up, and put it in the sun to dry; then take a pint and a half of ash-ley, in which squeeze and roll the thread well, and allow it to remain till next day.

4th, Squeeze and roll it in a like quantity of ash-ley, and put it in the sun to dry; when dry, squeeze and roll it again in the ley, and allow it to remain till next day.

5th, Let the same process be repeated three or four times, and intermit till next day.

6th, Ley the thread once, as the day before, and, when well dried in the sun, prepare the following liquor: One gill of Gingelly oil; one pint and a half of ash-ley.—In read well, and leave it so till

yesterday, and dry the thread

be repeated.
ey process three or four times,
, and 5, and then prepare the
nt of sheep-dung water; one
nt and a half of ash-ley.—In
hread well, and dry it in the

ocess.

clean water, and squeeze and
t dry; then put it into a vessel
d chaya root, one pint by mea-
en pints of clear water; in this
ut well, and allow it to remain

and dry it in the sun, and re-
5th process, leaving the thread

it in the sun, and repeat the
re.

in the sun, and with the like
pints of water boil the thread
to remain in the infusion un-

ll in clear water, dry it in the
complete.

J. MACHLACHLAN.

---

d Velocity of the Motion of the
By WILLIAM HERSCHEL,

een directed again to the con-
which I have already delivered

---

of the Royal Society for 1805.

several detached papers. The changes which have taken place in the relative position of double stars, have ascertained motions in many of them, which are probably of the same nature with those that have hitherto been called proper motions. It is well known that many of the principal stars have been found to have changed their situation, and we have lately had a most valuable acquisition in Dr. Maskelyne's table of proper motions of six-and-thirty of them. If this table affords us a proof of the motion of the stars of the first brightness, such as are probably in our immediate neighbourhood, the changes of the position of minute double stars that I have ascertained, many of which can only be seen by the best telescopes, likewise prove that motions are equally carried on in the remotest parts of space which hitherto we have been able to penetrate.

The proper motions of the stars have long engaged the attention of astronomers, and in the year 1783 I deduced from them, with a high degree of probability, a motion of the sun and solar system towards λ Herculis. The reasons which were then pointed out for introducing a solar motion, will now be much strengthened by additional considerations; and the above-mentioned table of well-ascertained proper motions will also enable us to enter rigorously into the necessary calculations for ascertaining its direction, and discovering its velocity. When these points are established, we shall be prepared to draw some consequences from them that will account for many phænomena which otherwise cannot be explained.

The scope of this paper, wherein it is intended to assign not only the direction, but also the velocity of the solar motion, embraces an extensive field of observation and calculation; but as to give the whole of it would exceed the compass of the present sheets, I shall reserve the velocity of the solar motion for an early future opportunity, and proceed now to a disquisition of the first part of my subject, which is the direction of the motion of the sun and solar system.

Reasons for admitting a Solar Motion.

It may appear singular that, after having already long ago pointed out a solar motion, and even fixed upon a star towards which I supposed it to be directed, I should again think it necessary to show that we have many substantial reasons for admitting such a motion at all. What has induced me to enter into this inquiry is, that some of the

be drawn from a solar motion,
contradict the very intention for
d. The chief object in view,
roposed to be deduced from ob-
tions of stars, was to take away
nvesting the sun with a contrary
, when its existence has been
y concealed real motions, that
of them than it would be ne-
n were at rest; and, to remove
for admitting its motion ought

Considerations.

he moons, or secondary planets,
d of these again round the sun,
additional motion of the latter
centre; and those who like to
of the heavens, might easily
otheses not altogether without
our. Accordingly we find that
hich is full of the most fantastic
system wherein the sun is sup-
ebula in Orion*. But, setting
of making this luminous spot
certainly be admitted that the
a very possible event.
in a note to my former paper†,
ar motion has also been shown
y the late Dr. Wilson, of Glas-
terwards, from reasons of the
ande. The rotatory motion of
cludes a displacing of the solar
llowed to indicate a motion of
ough it may be possible, it does
mechanical impression should
ithout occasioning the latter.
quainted with the cause of the
anslation in space from theore-
dmitted as a very plausible hy-

or those who have fixed instru-
gument by observing the stars

Mr. Lambert, p. 152 and 158.
ear 1783, p. 283.

which are known to change their magnitudes periodically. For, as we have great reason to ascribe these regular changes to a rotatory motion of the stars*, a real motion in space may be expected to attend it; and the number of these stars is so considerable, that their concurring testimony would be very desirable.

Perhaps Algol, which according to these ideas must have a very quick rotatory motion, may be found to have also a considerable progressive one; and if that should be ascertained, the position of the axis of the rotation of this star will be in a great measure thereby discovered.

An argument from the real motion to a rotatory one is nearly of equal validity, and therefore all the stars that have a motion in space may be surmised to have also a rotation on their axes.

Symptoms of parallactic Motions.

But, setting aside theoretical arguments, I shall now proceed to such as may be drawn from observation; and as all parallactic motions are evident indications that the observer of them is not at rest, it will be necessary to explain three sorts of motions, of which the parallactic is one; they will often engage our attention in the following discussion.

Let the sun be supposed to move towards a certain part of the heavens; and since the whole solar system will have the same motion, the stars must appear to an inhabitant of the earth to move in an opposite direction. In the triangle *s p a*, (Plate VIII.) Fig. 1, let *s p* represent the parallactic motion of a star; then, if this star is one that has no real motion, *s p* will also be its apparent motion; but if the star in the same time, that by its parallactic motion it would have gone from *s* to *p*, should have a real motion which would have carried it from *s* to *r*, then will it be seen to move along the diagonal *s a*, of the parallelogram *s r p a*; and *p a*, which is parallel and equal to *s r*, will represent its real motion. Therefore, in the above-mentioned triangle *s p a*, which I suppose to be formed in the concave part of the heavens by three arches of great circles, the eye of the observer being in the centre, the three sides will represent, or stand for, the three motions I have named: *s p* the parallactic, *p a* the real, and *s a* the apparent motion of the star. The situation and length of these arches, in seconds of a degree, will express, or rather represent, not only the direction but also the quantity of each motion, such as it

---

* See Phil. Trans. for the year 1795, p. 68.

e above-mentioned central situa-
r motion S, the distance of the
sine of the star's distance from
e sun is moving ϕ, the parallac-
given, will be had by the ex-
heorem, and its corollaries, of
made hereafter, it will not be
te.
the real motion, it should be
its representative; for it must
motion of a star in space, as
, will still remain unknown, be-
t motion on which also its real
s of the greatest variety of di-
uainted with the plane in which
ned, and with the length of the
that motion may be measured,
s of the arches representing the
est velocities of these motions
in every other direction but at
ght, the actual space over which
greater than the arch or chord
esented.
the sun will occasion parallactic
lows that these again must indi-
n order to ascertain whether pa-
ought to examine those stars
visibly affected by solar motion.
e brightest stars as the most pro-
y star may have a great real mo-
a great parallactic one, it must
the sun. And as we can only
he stars by their splendour, we
est, on account of a probability
t ones, they may be more within
thus better qualified to show its

for a criterion whereby paral-
from real motions; and this
For, if a solar motion exists,
tend to a point in opposition to
; whereas real motions will be
all parts of space.
n view, we may examine the pro-
per

per motions of the principal stars; for these, if the sun is not at rest, must either be entirely parallactic, or at least composed of real and parallactic motions; in the latter case they will fall under the denomination of one of the three motions we have defined, namely *s a*, the apparent motion of the star.

In consequence of this principle I have delineated the meeting of the arches arising from a calculation of the proper motions of the 36 stars in Dr. Maskelyne's catalogue, on a celestial globe; and, as all great circles of a sphere intersect each other in two opposite points, it will be necessary to distinguish them both: for, if the sun moves to one of them, it may be called the apex of its motion; and as the stars will then have a parallactic motion to the opposite one, the appellation of a parallactic centre may very properly be given to it. The latter falling into the southern hemisphere, among constellations not visible to us, I shall only mention their opposite intersections; and of these I find no less than ten that are made by stars of the first magnitude, in a very limited part of the heavens, about the constellation of Hercules. Upon all the remaining surface of the same globe there is not the least appearance of any other than a promiscuous situation of intersections; and of these only a single one is made by arches of principal stars.

The ten intersecting points made by the brightest stars are as follows: The 1st is by Sirius and Arcturus, in the mouth of the Dragon. The 2d by Sirius and Capella, near the following hand of Hercules. The 3d by Sirius and Lyra, between the hand and knee of Hercules. The 4th by Sirius and Aldebaran, in the following leg of Hercules. The 5th by Arcturus and Capella, north of the preceding wing of the Swan. The 6th by Arcturus and Aldebaran, in the neck of the Dragon. The 7th by Arcturus and Procyon, in the preceding foot of Hercules. The 8th by Capella and Procyon, south of the following hand of Hercules. The 9th by Lyra and Procyon, preceding the following shoulder of Hercules. And the 10th is made by Aldebaran and Procyon, in the breast of Hercules.

ives the calculated situation of
right ascension and north polar

Table I.

sion.	Polar Distance.		
50″	36°	41′	34″
32	64	21	48
58	58	23	24
38	44	39	47
58	32	7	23
19	33	57	20
13	46	21	34
49	73	7	56
49	66	48	11
29	60	59	34

with having shown that the pa-
we are in search is plainly to be
of the brightest stars; however,
ation, we may take in some large
whose motions evident marks of
nay likewise be perceived. When
by their proper motions and the
of the first magnitude are moving
less than fifteen which unite with
g out the same part of the heavens
t will be sufficient only to men-
of the situation of these intersec-
ich they are made, without giving
.

leg of Hercules, and is made by
2d is also in the following leg of
Andromedæ. The 3d is in the
es, by Sirius and α Arietis. The
Dragon, by Arcturus and β Tauri.
e and the northern wing of the
Andromedæ. The 6th near the
s, by Capella and α Arietis. The
of Hercules, by Lyra and β Tauri.
and northern wing of the Swan,
edæ. The 9th in the following
arm

arm of Hercules, by Lyra and α Arietis. The 10th in the following leg of Hercules, by Aldebaran and β Tauri. The 11th in the following leg of Hercules, by Aldebaran and α Andromedæ. The 12th in the head of Hercules, by Aldebaran and α Arietis. The 13th in the following arm of Hercules, by Procyon and β Tauri. The 14th in the back of Hercules, by Procyon and α Andromedæ. And the 15th near the following arm of Hercules, is made by Procyon and α Arietis.

An argument like this, founded upon the most authentic observations, and supported by the strictest calculations, can hardly fail of being convincing. And though only the ten principal apices of the twenty-five that are given have been calculated, the other fifteen may nevertheless be depended upon as true to less than one degree of the sphere.

Changes in the Position of double Stars.

We have lately seen that the alterations in the relative situation of a great number of double stars may be accounted for by a parallactic motion. Among the 56 stars which I have given, the changes of more than half of them appear to be of this nature; and it will certainly be more eligible to ascribe them to the effect of parallax than to admit so many separate motions in the different stars; especially when it is considered, that if the alterations of the angle of position were owing to a motion of the largest star of each set, the direction of such motions must, in contradiction to all probability, tend nearly to one particular part of the heavens.

This argument, drawn from the change of the position of double stars, may be considered as deriving its validity from the same source with the former, namely, the parallactic motions of at least 28 more stars, pointing out the same apex of a solar motion by their direction to its opposite parallactic centre.

Incongruity of proper Motions.

It may be remarked that the proper motions of the stars, if they were in reality such as they appear to be, would contain a certain incongruous mixture of great velocity and extreme slowness. Arcturus alone describes annually an arch of more than two seconds: Aldebaran hardly one-tenth and a quarter of a second: Rigel little more than one-tenth and a half: even Lyra moves barely three and a quarter tenths of a second, while Procyon has almost four times that velocity. Out of 36 stars, whose proper motion we

5 that do not reach two-tenths of
oves seventy-seven hundredths,
ut it will be shown, when the
he solar motion come to be ex-
incongruities are mere parallac-
there is so general a consistency
of the stars, that Arcturus is in
star whose motion is far beyond

place among the reasons for ad-
is not intended to lay any parti-
t may be objected that our idea
ony of the celestial motions can
al fitness and symmetry. But
er motions as those I have men-
different lustre are under consi-
ly shown to be only parallactic
y which this can be done must
nd, when added to many other
some share of weight into the

tion of a small Star.

portance with the former argu-
occultation of a small star by a
given in my last paper. When
established, we shall prove that
l star near δ Cygni, as far as we
only a parallactic disappearance.
cal motion of the large star would
enomenon; but then again, this
move towards the very same pa-
changes in the position of other
l this cannot be probable.

the Solar System.

id, I believe the expedience of
will not be called in question;
fore must be to investigate its

e-mentioned intersections of the
per motions of the stars are per-
oving that when the proper mo-
, an apex may be found, to which,
nove with a certain velocity, the
then be resolved into apparent
changes,

changes, arising from sidereal parallax, the stars remaining perfectly at rest.

Let the stars be Arcturus and Sirius, and their annual proper motions as given in the Astronomer Royal's Tables.

When the annual proper motion of Arcturus, which is — 1″,26 in right ascension, and + 1″,72 in north polar distance, is reduced by a composition of motions to a single one, it will be in a direction which makes an angle of 55° 29′ 42″ south-preceding with the parallel of Arcturus, and of a velocity so as to describe annually 2″,08718 of a great circle.

The annual proper motion of Sirius, — 0″,42 in right ascension, and + 1″,04 in north polar distance, by the same method of composition, becomes a motion of 1″,11528, in a direction which makes an angle of 68° 49′ 41″ south-preceding with the parallel of Sirius.

By calculation, the arches in which these two stars move, when continued, will meet in what I have called their parallactic centre, whose right ascension is 75° 39′ 50″, and south polar distance is 36° 41′ 34″. The opposite of this, or right ascension 255° 39′ 50″, and north polar distance 36° 41′ 34″, is what we are to assume for the required apex of the solar motion.

When a star is situated at a certain distance from the sun, which we shall call 1; and 90° from the apex of the solar motion, its parallactic motion will be a maximum. Let us now suppose the velocity of the sun to be such that its motion, to a person situated on this star, would appear to describe annually an arch of 2″,84825, or, which is the same thing, that the star would appear to us, from the effect of parallax, to move over the above-mentioned arch in the same time.

To apply this to Arcturus, we find by calculation that its distance from the apex of the solar motion is 47° 7′ 6″; its parallactic motion therefore, which is as the sine of that distance, will be 2″,08718; and this, as has been shown, is the apparent motion which observation has established as the proper motion of Arcturus.

In the next place, if we admit Sirius to be a very large star situated at the distance 1,6809 from us, and compute its elongation from the apex of the solar motion, we shall find it 138° 50′ 14″,5. With these two data we calculate that its parallactic motion will be $\frac{\phi \,.\, S}{r \,.\, d} = s\,p = 1'',11528$; and this also agrees with the apparent motion which has

been

ervation as the proper motion of

to the rules of philosophizing, we
motions than will account for the
situation of the stars, it would be
the motions of Arcturus and Si-
alone will account for them both;
uld be a sufficient inducement for
calculated apex, as well as on the
ve been assigned to these stars, if
ld with equal facility be resolved
pearances. But from the nature
ws, that when a third star does
pex as the other two, its apparent
d by the effect of parallax alone.
ulties, the number of apices, that
all proper motions into parallactic
number of stars admitted to have
en their situation happens to be
an arithmetical series of natural
continued to as many terms as
so that if two stars give only one
will give three apices; and ten,
ess than 45, and so on.

g which, on this subject, I have
ected with astronomical observa-
n constantly in view; and there-
has been advanced, by taking in
The three apices which then are
the mouth of the Dragon, by
cond under the northern wing of
Capella; and a third in the fol-
by Sirius and Capella. The cal-
le I.

ons of our third star in Dr. Mas-
1 in right ascension, and +0″,44
nd by calculation these quantities
0″,46374 to Capella, in a direc-
e of 71° 35′ 22″,4 south-follow-
s star.

from the same calculated apex
which we have already explained
e other two stars, is 80° 54′ 46″;
elocity of the sun towards the
, it will occasion a parallactic
motion

motion of Capella, in a direction 89° 54′ 48″ south-following its parallel, amounting to 2,8125″. In this calculation Capella has been taken for a star of the first magnitude, supposing its distance from us to be equal to that of Arcturus.

By constructing then a triangle, the three sides of which will represent the three motions which every star must have that is not at rest in space; we have one of the sides, representing the apparent motion of the star, equal to 0,4637″; the other side, being the parallactic motion of the star, 2,8125″; and the included angle 18° 19′ 27″. From these data we obtain the third side, representing the real motion of the star, which will be 2,3757″. By the given situation of this triangle with respect to the parallel of declination of Capella, the angle of the real motion will also be had, which is 86° 34′ 11″ north-following the parallel of this star. A composition of the parallactic and the real motion in the directions we have assigned, will produce the annual apparent motion which has been established by observation.

But to apply what has been said to our present purpose, it may be observed, that although we have accounted for the proper motion of our third star by retaining the same apex of the solar motion, which has given us an explanation of the apparent motions of the other two, yet in doing this we have been obliged to assign a great degree of real motion to Capella; and to this it may be objected, that we can have no authority to deprive Arcturus and Sirius of real motions, in order to give one of the same nature to our third star: and indeed to every star that has a proper motion which does not tend to the same parallactic centre as the motions of Arcturus and Sirius.

This objection is perfectly well founded, and I have given the above calculation on purpose to show that, when we are in search of an apex for the solar motion, it ought to be so fixed upon as to be equally favourable to every star which is proper for directing our choice. Hence a problem will arise, in our present case, how to find a point whose situation among three given apices shall be so that, if the sun's motion be directed towards it, there may be taken away the greatest quantity of proper motion possible from the given three stars. The intricacy of the problem is greater than at first it may appear, because by a change of the distance of the apex from any one of the stars, its parallactic motion, which is as the sine of that distance, will be affected; so that it is not the mere alteration of the angle

rned. However, it will not be
solution of the problem; for
hat a much more complex one
it, since three stars would cer-
lirect us in our present endea-
on of an apex for the solar mo-
leave these stars, and the apices
er to proceed to a more general

hat the brightest stars are most
ct of parallax, and that in our
the solar motion, our aim must
ions of the stars to their lowest
ipal stars, whose intersecting
en their proper motions in right
are brought into one direction,
ions contained in the following

ble II.

pparent	Quantities of the apparent Motions.
receding	1,11528″ per year
receding	2,08718
ollowing	0,46374
ollowing	0,32485
ollowing	0,12261
receding	1,23941
rent motions	5,35337″

hat has been said, when the con-
ressing the three motions of a
as explained; and, as we are to
hich will require the least real
ttention to this triangle will be
hen the line *p a*, Fig. 1, which
is brought into the situation
cular to *s p*, the real motion
be a minimum. It also follows,
e same triangle, that if by the
solar motion we can lessen the
es *s p* and *s a*, we shall lessen
required to bring the star from
the observed position *a*.
, in the case of Sirius and Arc-
only are given, the line *s p* may
be

be made to coincide with the lines *s a*, of both the stars, whereby their real motions will be reduced to nothing. It has also been proved, by adding Capella to the former two, that when three stars are concerned, some real motion must be admitted in one of them. Now, since all parallactic motions are directed to the same centre, a single line may represent the direction of the effect of the parallax, not only of these three stars but of every star in the heavens. According to this theory, let the line *s* P or *s* S, in Fig. 2, stand for the direction of the parallactic motion of the stars; and as in the foregoing Table we have the angles of the apparent motion of six stars with the parallel of each star, we must now also compute the direction of the line *s* P or *s* S with the parallels of the same stars. This may be done as soon as an apex for the solar motion is fixed upon. The difference between these angles and the former will give the several parallactic angles P *s a* or S *s a*, required for an investigation of the least quantity *m a*, belonging to every star.

For instance, let the point towards which we may suppose the sun to move, be λ Herculis; and calculating the required angles of the direction in which the effect of parallax will be exerted, with the six stars we have selected for the purpose of our investigation, we find them as in the following Table.

Table III.

Angles of the parallactic Motion with the Parallel.

Sirius - - -	32°	54′	8,5″	south-preceding.
Arcturus -	17	23	45,7	south-preceding.
Capella -	85	10	3,9	south-following.
Lyra - -	35	59	49,5	north-following.
Aldebaran -	71	21	35,4	south-following.
Procyon -	47	43	44,6	south-preceding.

The difference between these parallactic and the former apparent angles, with the parallel of each star, will give the required angles for our second figure. They will be as follows:

Table IV.

Angles of the apparent with the parallactic Motion.

Sirius - -	85°	55′	32,2″	south-following.
Arcturus -	38	5	56,3	south-following.
Capella -	13	34	41,5	south-following.
Lyra - -	20	21	7,8	north-preceding.
Aldebaran -	5	8	1,9	south-preceding.
Procyon -	2	18	39,9	south-following.

the assistance of the lines *sa*,
the annual quantity of the appa-
ur former table, the figure No. 2
hen the situation of these angles
re, we may draw the several lines
and, by computation, their value
as follows:

able V.

of the least real Motions.

- $0{,}65437''$
- 1,28784
- 0,10887
- 0,11281
- 0,01104
- 0,04998

Sum 2,22491″

stigation is, that by admitting a
ls λ Herculis, the annual proper
f which the sum is 5,3537″, may
of no more than 2,2249″.
Herculis as an apex for the solar
bered that a reference to future
or obtaining greater accuracy *.
now before us, in the valuable
aken the proper motions of the
e that, with their assistance, we
that will be considerably more

n, that to ascertain the precise
tended with some difficulty; but
figure which represents the quan-
d when λ Herculis is fixed upon,
egular method of approximation,
to a situation where all the angles
he six stars will be much reduced.
required for constructing another
eefold motions of our six stars,
ed upon, are to be found by the
ed in the instance of λ Herculis;
n given with respect to that star,
rallactic line SP should be turned

, p. 273, line 8; and p. 274, line 4.

more towards the line *sa*, representing the apparent motion of Sirius. We shall accordingly try a point near the following knee of Hercules, whose right ascension is 270° 15, and north polar distance 54° 45′.

The result of a calculation of the angles, and the least quantities of real motion of our six stars, according to this apex, is collected in the following table, and represented in fig. 3.

Table VI.

Stars.	Angles of the parallactic Motion with the Parallel.				Angles of the apparent with the parallactic Motion.				Least Quantities of the real Motion.
	°	′	″		°	′	″		″
Sirius -	68	51	5	S. preceding	0	1	25	S. preceding	0,0004561
Arcturus	29	30	32	S. preceding	25	59	10	S. following	0,9145072
Capella -	77	54	0	S. following	6	18	38	S. following	0,0509727
Lyra -	27	38	47	N. following	28	42	9	N. preceding	0,1557761
Aldebaran	66	20	17	S. following	10	9	21	S. preceding	0,0217607
Procyon	64	48	27	S. following	14	46	1	S. preceding	0,3159051
								Sum	1″,4593779

By this table it appears that the annual proper motion of our six stars may be reduced to 1,4594″, which is 0,7655″ less than the sum in the 5th table, where the apex was λ Herculis.

In the approximation to this point it appeared, that when the line of the parallactic motion of Sirius is made to coincide with its apparent motion, we may soon obtain a certain minimum of the other parallactic motions; but as Sirius is not the star which has the greatest proper motion, it occurred to me that another minimum, obtained from the line in which Arcturus appears to move, would be more accurate; for, on account of its great proper motion, we have reason to suppose it more affected than other stars by the parallax arising from the motion of the sun; and, with a view to this, I soon was led to a point not only in the line of the apparent motion of Arcturus, but equally favourable to Sirius and Procyon, the remaining two stars that have the greatest motions.

If the principle of determining the direction of the solar motion by the stars which have the greatest proper motion be admitted, the following apex must be extremely near the truth; for, an alteration of a few minutes in right ascension or polar distance either way, will immediately increase the required real motion of our stars. Its place is: right ascension 245° 52′ 30″, and north polar distance 40° 22′.

f the same stars by this apex will , and are delineated in fig. 4.

ble VII.

ictic allel.	Angles of the apparent with the parallactic Motion.	Least Quantities of the real Motion.
	° ′ ″	″
ling	10 24 44 following	0,20157
ling	0 0 3 preceding	0,00003
ling	24 40 21 following	0,19358
ing	92 49 30 following	0,32396
ling	13 18 58 following	0,02842
ling	9 40 46 preceding	0,20839
	Sum	0″,95595

tions required, with the apex of ntioned, is less in this table than 343″.

e have proceeded upon the prin- possible quantity of real motion, iost favourable situation of a solar it the sum of the observed proper pal stars, amounting to 5,3534″, nposition of two other motions; s of these stars, if they could be ossible quantities, would not ex-

o assert that these real motions lown to the low quantities that vill be necessary to show that the or establishing the method I have ed by that circumstance. In the l consider, that although the great s, Procyon, and Sirius, are strong affected by parallax, it does not that the apparent changes of the iould be entirely owing to solar , we may reasonably expect that vill have a great share in them. t that in the case of parallactic star from the sun is of material cannot be assumed at pleasure, at liberty to make the parallactic to the line *s m* of the same figure: real motion of the star cannot be from *m* to *a*, as the foregoing calculations have supposed; but will be from *p* to *a*. It is, however, very evident, that if *ma* be a minimum, the line *pa*, when *sp* is given, will also be a minimum; and if all the *ma*'s in fig. 4. are minima, it follows also that all the *sp*'s, whatever they may be, will give the *pa*'s as small as possible: and this is the point that was to be established.

Whatever, therefore, may be the sum of real motions required to account for the phænomena of proper motions, our foregoing arguments cannot be affected by the result; for, as by observation it is known that proper motions do exist, and since no solar motion can resolve them entirely into parallactic ones, we ought to give the preference to that direction of the motion of the sun which will take away more real motion than any other, and this, as we have shown, will be done when the right ascension of the apex is 245° 52′ 30″, and its north polar distance 40° 22′.

XLVI. *Life of* JOHN BEVIS, *M. D. F. R. S. &c. Communicated by Mr.* T. S. EVANS, *of the Royal Military Academy, Woolwich.*

JOHN BEVIS, M.D., fellow of the Royal Society of London, and corresponding member of the Academy of Sciences of Paris and Berlin, was born the last day of October 1695, (old style,) near old Sarum, in Wiltshire. His father distinguished himself very honourably, in the time of the Revolution, by raising and supporting, at his own expense, a company of infantry to assist king William, and expended in it the sum of 2000l., no part of which was ever reimbursed him by government.

The son, after receiving that kind of education which was necessary to qualify him for the university, was entered at Christ's college, Oxford, where he applied with great ardour, not only to the study of physic, for which he was intended, but also to many other sciences: he had, in particular, a strong partiality for optics, and was rarely without sir Isaac Newton's treatise on that subject in his pocket. This will not surprise us much, when we consider how necessary a knowledge of this science is to the one for the advancement of which he had so remarkable a predilection. Not contented with acquiring the theory of astronomy, he made himself also a proficient in the practical part, even while he was at college; and frequently amused himself tical purposes, in which he was

s, as far as doctor of physic, he
ade the tour of France and Italy,
enced the profession of medicine
great practice. But the study of
asure to compare with that which
plating the divine works of the
s.

38 he had procured an excellent
instruments*, for the purpose
vatory, which he had built under
n, at Stoke Newington, on the
this place, when he had esta-
e a most indefatigable observer,
olumes in folio, filled with ob-
le between the 6th of March in
arch in the following year. From
important, making one volume
per, where it frequently occurs
undred and sixty stars, &c. have
t.

bserve the heavens with the same
, when, finding he had collected
posed on himself the laborious
blishing by subscription, a work
Britannica; or An exact View of
Plates;" similar to that of Boyer,
tions and all the fixed stars that
onomers, together with a consi-
only been observed by himself.
nounced in 1748, are two hemi-
e constellations as they were laid
nomers †. To each plate he wrote
ith remarks; and joined a com-
xed stars, with their magnitudes
.

ld have done honour to his coun-
notwithstanding they have been
rs, have never come before the
ount:—He had engaged a person

---

possession a curious wire micrometer ca-
ich once belonged to the celebrated astro-

and 34 of Bode's small atlas.

to engrave them whose name was John Neale [*], and who, after he had received several hundred pounds of the subscription, became a bankrupt: by this means the work fell into the hands of Neale's creditors, and was at length put under the protection of the court of chancery, so that the author could never afterwards enjoy the fruit of great labour [†]. What was still worse, the subscribers to this excellent work, having been thus disappointed, supposed that Dr. Bevis had some connection with Neale in his misconduct; which being told him, he felt himself so much chagrined by it, that he never spoke of this unpleasant business during the remainder of his life, without feeling himself in some degree affected. Mr. Horsefall, whom he left his executor, and who was very fond of astronomy, used every means in his power to forward the suit after the doctor's decease: he even offered to give up his own interest in the affair, to bring it to a final conclusion, that the work might be published; but to no purpose. Very great pains had been taken with it; and, besides the previous labour, many whole days were spent by the side of the engraver, to see that every star was laid down in its proper position. At the commencement of the suit there was very little to finish for the press, all the plates being ready.

Dr. Bevis was the author of a great many works, which have been well received by the public; but his modesty would not permit him to take the merit of them to himself [‡]. It is to him we are indebted for the publication of the celebrated Dr. Halley's astronomical tables, with whom he was intimately acquainted. They were left from the year 1725 till his death in the hands of the printer, where, perhaps, they might have shared the same fate as the atlas before mentioned, had not Dr. Bevis taken them up, and by supplying the necessary auxiliary tables, and precepts to use them, brought them to light in the year 1749 [§].

In Mr. Thomas Simpson's Essays, p. 10, are given prac-

---

[*] This John Neale published a pamphlet containing some improvements in the barometer.

[†] Lalande says that the doctor showed him the proofs when he was in England in the year 1763, at which time they were still in custody, but that M. Messier had a set of them. (*Astr.* vol. i. p. 242, 3d edit.)

[‡] Heath says, p. 234 of his Royal Astronomer, that Gael Morris was the precept writer to Dr. Halley's tables. Possibly G. Morris might assist Dr. Bevis, or actually write them under his inspection; but there is no doubt that Dr. Bevis was the responsible person concerned.

[§] Dr. Halley expected to bring the theory of the moon to a greater state of perfection, and the publication of the tables was delayed for that purpose. M. de l'Isle, with whom Dr. Halley as well as Dr. Bevis corresponded, has published two curious letters on the history and theory of these tables.

berration, which were drawn up
s, together with examples of the
al stars, which he had himself
er instruments; whereby, as Mr.
proved, the first of any one, that
rsally as conformable in right
who made this great discovery,
ation.

d of Longitude on the 18th Sep-
inated, jointly with Mr. George
pbell, to compute the observa-
and compare them with those
sewhere, for the purpose of as-
Mr. Harrison's timekeepers.

n in which he was held by ma-
only observe, that the ingenious
ed to him his translation of
luable *Astronomie Sphérique*;
count of his well known literary
ld write a letter of recommenda-
ictionary, which has always, on
ame of Dr. Bevis's dictionary.

ilosophical Transactions, from
ve, with twenty-seven valuable
astronomical observations; and
gs in the Mathematical Maga-
Witchell, particularly a curious
nus.

Journal des Sçavans for August
n of Lalande's Astronomy, done
it has never been published, al-
ess at his death.

ave appeared separately with his
; one entitled "The Satellite
ning the immersions and emer-
of Jupiter; the other was "An
rning the Contents, Qualities,
the two mineral Waters lately
ells, near London; with Direc-
nd some Account of their Suc-
vo. London, 1760. A second
s given by him in 1767.

genious Mr. John Dollond, of
ented the method of correcting
f rays of light passing through
hereby of shortening the length
of

of telescopes, by using a compound object glass, composed of a convex lens of crown glass and another concave one of white flint glass; or else, by means of two convex ones of crown glass, and one concave one between them of white flint glass. Dr. Bevis was the first who gave the name of *achromatic* to telescopes made in this manner, which name has ever since been universally adopted both at home and abroad. This invention induced him to make some curious experiments on the refractive power of glass, in the composition of which he had used a quantity of borax, and found the refrangibility was about as great as that of English crystal.

The French astronomers had always received the credit of being the first inventors of the wire micrometer, until Dr. Bevis, in looking over some letters, the originals of which were in lord Macclesfield's library, found, by accident, that Gascoigne first invented it in the year 1641, whereas Auzout's letter to Mr. Oldenburg, which only mentions his having *used* it to measure the sun's diameter, was not dated till the 28th of December 1666.

M. Grischou, when he was at Leyden in 1749, engaged M. Schultens, professor of Arabic in that city, to translate the manuscript, in the public library of that city, containing the observations of Ibn Iunis, made at Jaffa, about six or seven miles from Cairo, in Egypt, in the years 977, 978, and 979, where are recorded, among other things, two remarkable eclipses of the sun. Dr. Bevis procured a copy of this manuscript in order to compare modern observations with these antient ones, for the purpose of settling the maximum of some equations in the solar tables; but in the course of his researches he found them so obscure and unsatisfactory that he was obliged to reject them. He afterwards presented this manuscript to M. de l'Isle, and it has lately been translated into French by M. Caussin, and inserted in the *Mem. de l'Instit. Nat.* tom. ii.*

At the death of Mr. Bliss, in 1765, his friends made great exertions to procure for him the situation of astronomer royal; but Dr. Maskelyne obtained it through the interest of the earl of Macclesfield, who was at that time president of the Royal Society. His majesty, notwithstanding he could not comply with his wishes in this instance, was very partial to him, and requested his assist-g the building of the observatory

---

* An analysis of this curious and valuable manuscript may be seen in the first volume of Dr. Garnett's Annals of Philosophy, p. 105. La Place has derived great benefit from the use of it.

ost of the principal astronomers
t; and many of them make very
r works of the civilities and at-
him, either during their stay in
tions to them abroad.
f the Royal Academy of Sciences
of June 1750, and was accom-
d flattering letter from the cele-
president of that academy, in
the work above mentioned, he
atlas.”
he was chosen corresponding
emy of Sciences at Paris.
eath he left the house in which
e Newington, and removed into
per situation of his house for
approaches of old age, his oc-
and at the Royal Society, now
nuing his observations so regu-
eless he had his astronomical
escopes, about him, to amuse
gratify a friend with the sight
on when it occurred in the hea-

d by a fall which he received a
rather too hastily from his in-
bserving the meridian altitude of
of November 1771, aged 76, in
tly free and resigned, and with
of mind becoming a christian

as lively, amiable, and liberal:
e in embarrassment, of whatever
s, without sympathizing in his
relief if possible.
ial service to astronomy by the
ssistance he gave to astronomers,
as foreigners. He was always
er refused his advice when they
struments or make observations;
d any pains or trouble that con-
gress of astronomy.

XLVII. *On*

XLVII. *On the magnetic Attraction of Oxides of Iron.*

By TIMOTHY LANE, *Esq. F.R.S.*[*]

HAVING found, by experiment, that hardened iron is not so readily attracted by the magnet as soft iron, and that needles are inferior to iron wire as indexes to Six's thermometer, I was proceeding to other comparative experiments when I received the Second Part of last year's Philosophical Transactions, in which I saw an Analysis of Magnetical Pyrites, with Remarks on Sulphurets of Iron, by Mr. Hatchett.

This paper led me to examine what magnetical properties iron possessed when free from inflammable matter. For this purpose I obtained a precipitate of iron prepared and sold at Apothecaries' Hall by the name of *ferrum præcipitatum*. Mr. Moore, the chemical operator, informed me that he prepared it by dissolving twelve pounds of sulphate of iron in twenty-four gallons of distilled water, and then adding eight ounces of sulphuric acid to render the solution more complete. Twelve pounds of purified kali were mixed with the solution: the precipitate was well washed with hot distilled water, and then carefully dried. This precipitate is similar to the sediment of chalybeate waters, and affords no magnetic particles; nor, when exposed to a continued clear red heat, does it suffer any alteration beyond the acquirement of a darker colour. But if any smoke or flame has access to it, then magnetic particles are evident. Heat, by the converging rays of the sun[†], equal to that at which glass melts, blackens the oxide, but does not render it magnetic, if free from any inflammable matter. It is requisite, in this experiment, to protect the oxide, by glass, from the dust floating in the air, which otherwise will render many of the particles magnetic. I attributed this effect to the deoxidizing property of light, till, by employing a protecting glass, the result proved it to proceed from the dust in the atmosphere.

By repeated experiments I found that heat alone produced no magnetic effect on the oxide, and that inflammable matter with heat always rendered some of the particles magnetic.

As the inflammable matter in coal had this effect, I mixed some of the oxide with a portion of coal in a glass mortar, and continued rubbing them together for some time without any

---

[*] From the *Transactions of the Royal Society* for 1805.

[†] The lens employed in this experiment was twelve inches in diameter, and the heat at its focus was sufficient to melt iron: from Mr. Dollond.

mixture was then put into a to-
the clear red heat of a common
had acquired a red heat, it was
was put on a glazed tile to cool,
c.

original oxide in a glass mortar
s, as sulphur, charcoal, camphor,
und that no effect was produced
eat. The heat of boiling water,
it; but by the heat of melting
n. Small quantities of any in-
heat have an evident effect on
led by a red heat, renders the
has the same effect. But if the
ater, though it may flame in the
s it is driven off before the oxide
to receive its action.

nces as do not very readily part
nt, require rather longer conti-
; for example, charcoal and cin-
longer in the fire to have their
in dry wood, coal, or sulphur.

may be sublimed with facility,
ide, by a continued application
it unmagnetic, as at first.

on of inflammable matter is re-
rable quantity of oxide magnetic
of camphor dissolved in an ade-
nd mixed with a hundred grains
rtar, will, by a red heat, render
e magnetic.

refore, are rendered magnetic by
lammable matter, it may be un-
e, sulphurets, and ores of iron
atter, become magnetic by the
e same time it is observable that
heir unmagnetic state, when the
sufficiently long to drive off the
matter: thus we find among the
calcined sulphurets of iron, di-
colour, unmagnetic when all the

mmunication is to prove generally
e not magnetic; that any inflam-
with them do not render them
heat chemically combined with
the

the oxides, and that when the combustible substance is again separated by heat, the oxides return to their unmagnetic state. That magnetic oxides cannot be distinguished from calcined oxides by their colour. I entertain a hope, however, that this subject may be found worthy of the accurate investigation of some other member of this learned society.

XLVIII. *Extract from a Memoir of Messrs.* FOURCROY *and* VAUQUELIN *upon the Discovery of a new inflammable and detonating Substance formed by the Action of Nitric Acid on Indigo and Animal Matters. By* A. LAUGIER*.

THE application of the nitric acid to vegetable and animal matters has produced, it is well known, a multitude of important discoveries. The disengagement of a part of the azot of animal compounds, and their conversion into oxalic acid, as observed by M. Berthollet, together with the discovery of the formation of ammonia and the prussic acid by M. Fourcroy, form a brilliant æra in the history of chemical science. The changes which organic compounds suffer by the action of nitric acid, which produces nine or ten different substances, themselves compounds, are so multiplied and various, that they excite the astonishment of chemists, and induce them to regard this action of the nitric acid as a rich mine to labour in: that it is still far from exhausted will appear from the discovery of two substances, hitherto almost wholly unknown, which form the subject of this memoir.

The most remarkable of these is produced by boiling nitric acid upon animal substances or vegetables containing azote. It is of a yellow colour, has an intensely bitter taste, and is distinguished by its property of inflaming and detonating with violence when exposed to a moderate heat.

M. Haussmann, by a memoir which appeared in the *Journal de Physique* (March 1788), where he relates some experiments on indigo with the acids, seems to have seen this substance. Although he confounds it with the oxalic acid, yet its properties are pointed out by him with sufficient accuracy; its bitterness, its yellow colour, its solubility, and its precipitation by alkalies: but its principal property of

---

* From the *Annales de Chimie*, No. 165.

nation, of course its intimate and
ether escaped him.
by Welther the bitter principle,
power of detonating, seems to be
has attributed this peculiarity to
of nitrate of potash.
mode of procuring the substance
r parts of nitric acid, of 18 or 20
one part of powdered indigo of
r is destroyed, while the acid be-
ere remains on the surface only a
ter, which becomes firm by cool-
ed, the solution evaporated to the
l the residuum dissolved in hot
lution of the potash of commerce
ie liquor, when a number of small
ar shape will appear, forming the

en separated may, by the addition
be also converted into the same
ce.
ped before the point mentioned,
detonating substance, a matter of
llized, but more soluble in water,
of white needles.
all the characters of benzoic acid,
he resin. In all probability the
ss decomposes or volatilizes this

the detonating matter; its bitter
ling water, in alcohol, and, above
deep blood-red colour which it
n of alkalis, and which it com-
te from the sulphate of iron; the
eres to the benzoic acid which is
he action of the nitric acid upon
perty of detonating strongly with
wrapped up in a bit of paper and
are characters which sufficiently
from every other with which we

of this memoir have ascertained
ty of the new substance depends
nitric acid nor on that of ammo-
huric acid disengaged from it no
acid

acid vapours, and caustic potash no ammonia. They are, on the contrary, inclined to believe that potash has some share in the effect of detonation; since acids in which this substance has been digested contain traces of salts having potash as their base. When deprived of alkali this substance is more soluble in water, and crystallizes in elongated plates of a yellow colour and bitter taste, having acid characters: these crystals, if moistened with potash, resume their detonating property. The potash seems merely to render this substance more fixed; to favour the accumulation of caloric, and to determine, consequently, the combustion of the elements which compose it; viz. of the carbon, the hydrogen, and perhaps of the azote, by means of the oxygen which it also contains.

Indigo is not the only substance which furnishes this detonating composition; the muscular fibre treated with nitric acid presents the same phænomena; and it is probable that silk, wool, and other animal and vegetable matters containing azote will also furnish it.

The labours of Messrs. Fourcroy and Vauquelin present two very interesting facts. It follows, 1. That the benzoic acid may be formed from a multitude of different substances, which we were formerly ignorant of: 2. That animal and vegetable substances containing azote, if treated with the nitric acid, which takes from them a portion of carbon, of hydrogen, and of azote, give birth to a matter supersaturated with oxygen, and possessing the property of detonation. This substance, which the authors of the memoir have examined with care, appears to them to be a superoxygenated hydro-carburet of azote.

XLIX. *Third Communication from Mr.* W. Peel, *of Cambridge. On the Production of Muriates by the Galvanic and Electric Decomposition of Water.*

To Mr. Tilloch.

SIR,

I feel no little satisfaction at the interest my experiments have excited, and the favourable reception they have met with from you.

I have now the pleasure to inform you, that since my last letter, dated the 4th of June, (Phil. Mag. vol. xxii. p. 153.) having had some leisure time upon my hands, I have dedicated as much of it as my health would permit to the subject on which I then

xi. p. 279.) dated the 23d of
riefly, that by decomposing, by
ne-half of a whole pint which
, I had obtained in the remain-
uriate of soda. In my letter
ned you, that on repeating the
formed by the combustion of
saturated with lime to free it
vith which it was found tinc-
ad, instead of muriate of soda,
obtained muriate of potash.
am now to state, were under-

er the difference in the resul
periments was owing in an
ed lime to neutralize the wate
riment, before it was distilled.
the salts found in the residua
rt of them, came from the Gal-
e wires.
int, I varied my experiment b
water distilled under differen

yed in this experiment was di
g *lime*. A portion of it wa
that has before been stated
muriate of potash.
rom water containing *magnesi*
manner. The result was *mu*

ent double distilled *snow wate*
was *muriate of soda*.
from *barytes* was now used
of soda.
the experiment detailed in m
m pump water (the pump is o
which I have not myself ana
n so good as to take upon hi
been able to detect in it th
ia. In one of the above expe
distilled from magnesia, I ob
t, having obtained the same re
er, and from water distilled fro
barytes

barytes, I conclude that the production of the soda has nothing to do with the presence of magnesia.

But in the production of potash the presence of lime seems to be essential, and, as you hinted, a portion of lime must have been carried over with the distilled water; a fact which few would suspect, and which probably may often be the cause of differences in the results of chemical investigations, conducted, to all appearance, in a similar manner.

To determine the second point which I had in view; namely, whether the salts found in the residual water, or any component part of them, came from the Galvanic battery by means of the conducting wires, I made similar experiments to those before stated, employing for the decomposition of the distilled water a powerful electrical machine instead of a Galvanic battery, but without obtaining results different from what have been already stated.

I am now engaged in an experiment concerning the formation of potash; but, being desirous that my present letter, which I write in haste, may reach you in time for this month's Magazine, cannot wait for its result. Should the experiment succeed, you shall be informed as soon as possible. In the mean time I remain, with the greatest regard, yours,

W. Peel.

Cambridge,
Dec. 20, 1805.

L. *Experiments on Gum Arabic and Gum Adraganth.*
By M. Vauquelin*.

1. Ten grains of red gum adraganth, furnished by combustion three decigrammes and a half of white ashes. These ashes dissolved in muriatic acid with effervescence, and gave out an odour of sulphurated hydrogen. Their solution gives by ammonia a precipitate which consists of phosphate of lime and oxide of iron. The oxalate of ammonia precipitates a considerable quantity of lime.

Thus the red gum adraganth contains in a hundred parts about three and a half of ashes, which are composed, for the greater part, of carbonate of lime, of a small quantity of iron, of phosphate of lime, and perhaps also a minute portion of alkali.

2. Ten grains of white gum adraganth, submitted to the same proofs, yielded three decigrammes of ashes, which

---

* From the *Annales de Chimie*, tom. liv.

principles as those of the red
there was extracted a small
1.

bic, burnt like the others, left
which were composed of the
ceding; with this difference,
symptoms of the presence of
the others.
hat the opacity of gum adra-
ch it has to dissolve in water,
e of a very great quantity of
e experiments it appeared they
.

not found in the state of a com
state of quicklime; for the so-
ine, they are, on the contrary,
ne rub on a morsel of gum a
stened, it is sensibly reddened.
ate of ammonia and carbonate
ations in the solution of gum
of lead is not there formed at
that there is lime in the gums,
t what is this acid?
I shall be obliged to give way
re very probable, which every
othing to contradict. It is not
vegetable acid; for, on being
bases combined with carbonic

among the great number of
t satisfy all those conditions.
r the tartareous acid, nor the
ations with lime are insoluble
use they exist in only a small
less can it be the benzoic, the
honistic acid; which, as we
re, and of which the three first
y little soluble.
to choose between the acetous
st forms, as we know, soluble
vn substances with which it is
them are even deliquescent.
frequent in the operations of
animal system; since it forms
ntation, the action of powerful
eat.

The combinations of the second are the greater part insoluble in water; that which it forms particularly with lime is not sensibly soluble but by the aid of an excess of acid, and its existence in nature is not so frequent as that of the acetic acid; and since the lime which is found in transparent gums has been incontestibly dissolved in the juices of the vegetables which furnished these substances, it is much more probable that this earth is there combined with the acetic acid than with any other.

It is very probable that the small quantity of potash which I found in the ashes of the burnt gums is united to the same acid, which would explain why these substances are so sensible to humidity, and soften themselves so as not to be pulverizable.

I am, however, very much disposed to believe, that in certain opake adraganth gums difficult to dissolve, and which give much lime by incineration, this earth is there combined with the malic acid. I have had occasion to examine lately a gum collected by M. Pallissot-Bauvois on the nopal of cochineal, which was opake, swelled itself in water, but did not dissolve in a homogeneous manner, and which gave eight per cent of lime.

As the sap of all the cactus which I have submitted to analysis has afforded me quantities more or less considerable of the acidulous malate of lime, one may presume, with sufficient reason, that the kind which nourishes the cochineal contains it also; and that it is the presence of this salt, proceeding from the vegetable when dissolved in the sap with the gum, which gives it its opacity, and hinders its solution in water.

It results at least from these experiments, that the gums contain, 1. A calcareous salt, most frequently the acetate of lime: 2. Sometimes a malate of lime with excess of acid: 3. Phosphate of lime: 4. Iron, which is probably united to phosphoric acid.

LI. *A proposal for destroying the Fire- and Choak-Damps of Coal Mines; and their Production explained on the Principles of modern Chemistry: addressed to the Owners and Agents of Coal Works, &c.*

The subjoined remarks are extracted from a little tract which professes only to hold out a short explanation of well known facts, in the hope of seeing them conducive to save human beings whose labours are useful to the com-

destroying

pular manner, and, we think,
to whom it is addressed.
r when *carbonaceous* matter,
ith it, and the affinity which
for carbon, account satisfac-
of *fire-damp* (hydrogen gas)
acid gas). The hydrogenous
being so much less than that
, or 16 to 1, if perfectly pure,
: the carbonic acid gas, owing
re than twice that of common
ien these two do not by their
he floor and top of the mine,
ies between them, being nei-
mp nor so light as the *fire-*
n nor carbonic acid gas are
mospheric air; and wherever
be in contact or mixture with
be inflamed without it:—the
the formation of water which
nd of oxygen 0·85; and thus
hed with the explosion of fire-
with water.—Such, briefly,
by the author, Dr. Trotter.
ing his object, points out,
he formation of noxious airs
ing them when formed.
ould be as well ventilated as
but one great object ought to
f water; for where there is no
ration of the foul airs. Where-
ream of pure water should be
and sweeten it, that the whole
chips of wood, or horse dung,
th the water that may become

ve have only to employ some
e of vapour, such as the acetic,
tic. These acid vapours seize
nsible state of the acid gas its
ase of the acid and attracts the
sed, but the caloric disengaged
he oxygen and hydrogen con-
is not seen in a condensed state.
f destroying hydrogenous gas,
ated muriatic acid gas, on ac-
count

count of the extra oxygen which it contains, is the best for this purpose.

" The utensils required for this business are small flat stone dishes, made thick, about two inches deep; and a glass funnel for pouring in the acid of vitriol. The ingredients are, common salt (it ought to be bay salt), oxide of manganese, and concentrated acid of vitriol, which, in common language, is the strongest oil of vitriol.

Proportion for one Fumigation.

	oz.	dr.	grs.
" Take of common bay salt -	3	2	10
Fine powder of black manganese	0	5	17
Water - - - - -	1	2	33
Strong sulphuric acid - -	1	7	50

" After pounding the salt and manganese together, they may be put into the stone ware dish, and the water poured upon them; and afterwards the sulphuric acid, slowly, through a glass funnel. This quantity is sufficient for a space of 16 feet by 12; but the frequent employment must depend on the manner how the *fire-damp* is evolved."

To remove the choak-damp from coal mines the author recommends the use of water.

" Water, about the temperature of 40° of Fahrenheit, is found to dissolve equal parts of its bulk; but as the water of a deep pit is commonly above 50°, it will take up two-thirds of its bulk only. In order to effect this mixture with water, I would recommend (says the author) the common fire-engine, such as is used in the case of fire. The workmen might for safety stand at a distance, and by directing the mouth of the tube to the spot where the *choak damp* is known to lie, the water may be so diffused as to take up the whole. The water will then taste acidulous, and lights will burn, and animals breathe, in the place whence the vapour was dislodged. That the diffusion of the water might be more speedy in dissolving the *choak-damp*, the tube might be fitted after the manner of a garden watering-pot, so as to sprinkle and break the fluid into a shower.

" This kind of air being speedily attracted by quicklime, by mixing that article in the water which is to be diffused would still more effectually dislodge the *choak-damp*; and in places where it happens to be collected in great quantity, such a mixture would be highly serviceable.

" It ought to be remembered, whenever either *fire-damp* or *choak-damp* are detected in coal-pits, that there will be reason to fear a collection of the other near the spot, if not

is without doubt that they are
same process and at the same

osed by Dr. Trotter for destroy-
ps in coal mines. The ingre-
cheap, that " the largest mine
dred pounds (value, we suppose,
keeping the fumigation in con-
ut the constant use of it would,
for too free an inhalation of
to produce pleurisy, and many
malady in different works when
l for the purpose of bleaching.
s, however, not the less praise-
ersight militate against a fair
of the means he has suggested.
the mines are worked in the
g the mine the fumigating pans
, and the desired end probably
e return to their work in the

---

ssac *to M.* Berthollet, *on*
*cid in Animal Substances**.

out four months ago, you were
th the existence of fluoric acid
have since received from you
discovery. I conceive, there-
fied by the communication of
g it from M. Morichini, a Ro-
s discovery was made. As it
arly as the year 1802, you will
t should have remained so long
ited so little the attention of

of an elephant was found in
an account of which has been
in the *Journal de Physique* of
this fossil elephant are formed
ces; the inner of these is os-

---

de Chimie, No. 165.

seous, translucent, of a pale yellow somewhat resembling horn; the outer, or enamel, is very white, breaks easily, and has a rough fracture. The osseous portion is most observable on the upper surface of the tooth, where it forms triangular figures having rounded angles, and passes in plates even to the root of the tooth, filling up the spaces left by the enamel. On examining these two substances, count Morozzo conceived that they must be different, and begged M. Morichini to analyse them. This chemist soon discovered, by the application of the sulphuric acid, that the enamel of the *molares* of the fossil elephant was almost entirely composed of the fluate of lime, together with a small proportion of the phosphate and carbonate of the same substance: the osseous substance, however, he found to be principally formed of phosphate of lime. Such are the first general results obtained by M. Morichini: they have been published in the Memoirs of the Italian Society in this imperfect state, as he had not then leisure to extend his experiments further. Since that time, however, he has ascertained, with accuracy, the nature and proportions of the several substances composing the fossil tooth: he has also analysed the enamel of human teeth. M. Josse, as you well know, analysed this last; but there was still a great deal to be done; for his experiments offered no satisfactory account of the difference existing between the enamel and the bony part of the tooth. As M. Morichini has assured me his late experiments will certainly appear in the Memoirs of the Italian Society, I shall not enter into any detail of them, but merely relate the principal results.

M. Morichini, having separated a portion of the enamel of human teeth, and suspecting that it resembled in its composition that of the *molares* of the elephant, treated it in the same manner, and discovered, to his great satisfaction, that it contained a large proportion of fluate of lime. And to render his experiment more conclusive, he submitted to the same tests the two enamels and the fluate of lime. Under the action of the concentrated sulphuric acid, the last of these three substances gave out readily copious vapours of fluoric acid: the enamel of the fossil teeth emitted them rather more slowly, and that of human teeth with still [illegible] rapidity. M. Morichini, however, remarks, that this difference is wholly owing to the presence of an animal substance in the two enamels, which is more abundant in that of human teeth than in the enamel of the fossil; and to prove it, he asserts that we may retard the disengagement of the acid from fluate of lime by adding to it, after calcina-

latine, and then drying it. T
substances yield by the sulphu
property of corroding glass, a
etions in water, or on a mo
other characters which it wou
, but which, taken in conjun
l not permit us to doubt th

nents of M. Morichini, 100 pa
eth contain thirty of animal su
lumine, and carbonic acid; a
nd phosphoric acids, in combin
een unable to separate accurat
uoric acid, but conceives that t
ll quantity.
of the fossil elephant is likew
ents, but in different proportion
uoric acid than that of the hum
mal substance. M. Morichi
is difference in the quantity
o enamels very probably ari
matter of human teeth, whi
ate completely from the enam
ult, and that which we least s
luoric acid in animal substanc
value, and one from which
important consequences.
ecting the presence of fluate
teeth, are no doubt contrary
s subject; for M. Josse, who
man teeth *, and Mr. Hatchett
ossil elephant's tooth, have b
nce besides the phosphate of lin
chemists induced M. Morich
rous examination: but his ex
iplied that there can now be
upon this subject.
the phosphate of lime of Est
n of fluate of lime, and that
sts of a large proportion of t
of phosphate. M. Morichi
periments, which prove that th
nited in animal substances, c
the phosphate of lime of Est

---

† Phil. Trans. 1799.

madu

madura, and the earth of Mamarosch, may have arisen from the decomposition of the skeletons of large terrestrial animals.

Upon learning that the fluoric acid existed in the enamel of teeth, I immediately recollected that Rouelle had formerly announced that he was unable to procure phosphorus from ivory; and I suspected that it might be similar in its composition to enamel. I therefore calcined a quantity of ivory, and poured upon it concentrated sulphuric acid: vapours were now disengaged, which I readily recognised to be those of the fluoric acid. The tusks of the boar afforded the same results. When I say that these two substances contain fluate of lime, I would not be understood to assert that they are wholly composed of it, because I had no means of making an accurate analysis; the vapours of the fluoric acid, however, are so abundant, that we should be led to believe its combination with lime forms a very large part of their composition.

A few days after these experiments I examined, along with M. Morichini, a portion of fossil ivory which had been found in the neighbourhood of Rome. Its concentric layers, both external and internal, yielded the fluoric acid in great abundance. I attempted also to analyse the bones of fish; but I have made only a single experiment on those of the tench; and from this I confess I dare not say any thing decisive.

You perceive then, my friend, that it is highly probable the enamel of the teeth of all animals is formed, in a great measure, of the fluate of lime; and it may be remarked, that their canine teeth are either entirely composed of the enamel, or contain a much larger proportion of it than the others. As we have hitherto found in the urine all the different substances composing the bones, have we not ground for believing that it also contains the fluoric acid? If at a certain period of life the fluate of lime can be deposited upon the teeth, it appears necessary that when these have acquired their full growth this substance should find some outlet from the body.

What is the origin of this fluate of lime in animal substances? Although the presence of fluate of lime in the phosphate of lime of Estramadura has occasioned a suspicion that one of the acids forming these salts may be a modification of the other, this opinion appears to me to have but little foundation; for the co-existence of the two substances proves nothing as to their intimate nature: and we may readily convince ourselves, by simply inspecting a fossil

at the osseous part is terminated
en smooth on one side; which
case were the enamel changeable
is last into enamel. If the fluoric
bodies of animals, which seems
n, but is only carried thither by
which furnish their nourishment,
acid in these substances.
see what extensive and important
e made upon the single point of
d in animal substances. M. Mo-
bject of right belongs, proposes
ation: the field, however, is so
sufficient employment for the
ts.

---

gs of Learned Societies.

CIETY, LONDON.

this society, which should have
of November, was postponed to
e former having been appointed
sgiving.
November, being St. Andrew's
eld their anniversary meeting at
rset Place, when the gold medal
's) was presented to Humphrey
communications published in the
.
proceeded to the choice of the
he ensuing year, when, on exa-
eared that the following gentle-
uncil:
The right honourable sir Joseph
arles Blagdon, knt.; Henry Ca-
y, esq.; Edward Whitaker Gray,
Charles Greville; William Mars-
skelyne, D. D.; George earl of
lord bishop of St. Asaph; Wil-
D.
Ir. John Abernethy; George earl
nchard Goodenough, esq.; ho-
ille; Philip Metcalf, esq.; Mat-
tenant-colonel William Mudge;
John

John Townley, esq.; William Charles Wells, M.D.; Thomas Young, M.D.

And the officers were,—The right honourable sir Joseph Banks, K.B. president; William Marsden, esq. treasurer; Edward Whitaker Gray, M.D., William Hyde Wollaston, M.D., secretaries.

Afterwards the members of the society dined together, as usual, at the Crown and Anchor Tavern, in the Strand.

On Thursday the 12th of December, the right honourable Charles Greville in the chair, minutes of the transactions of the council were read, with the above lists of officers, and a state of the funds of the society.

Letters were read from Drs. Maskelyne and Herschel mentioning their having observed a comet on the evening of the 8th instant, about six o'clock. It appeared like a star of the third or fourth magnitude, with a large coma, but no tail. It was not visible the succeeding evening.

A paper was also read on the dissection of a peculiarly formed heart, by Mr. Wyatt. It belonged to the body of a young woman who died of a mortification in her feet at the age of twenty. For forty days before her death, a chlorotic paleness pervaded her whole frame; her feet and legs were somewhat swelled, and painful; and her appetite continued good till the day she expired. When her body was opened by Mr. Wyatt, he found the heart nearly divided by a callous substance that obstructed its functions in receiving and discharging the blood through the aortas. To this cause, the obstructed or imperfect circulation, he ascribed the mortification of the extremities. The paper was illustrated by a drawing of the singular appearance of the heart.

Thursday, December 19, the right honourable Charles Greville in the chair, commenced the reading of a paper on guiacum, by Mr. Brandé, communicated by Mr. Hatchett, who has placed an accurate knowledge of this subject among the chemical desiderata, where, we fear, it must yet remain. Mr. Brandé agrees with Mr. Hatchett that guiacum is a peculiar substance, which he chooses, for the present, to denominate an extracto-resin, differing, as he says, from the other resins in having an extraordinary quantity of what is usually denominated extractive matter. Its peculiarities seem to consist principally in its different solutions in the acids being of very different colours, all of which are ascribed by Mr. Brandé to the presence of oxygen. Some, however, may be inclined to believe that different combinations of matter must present different surfaces or powers

that, consequently, a great variety
ced without having recourse to the
gen on every occasion. We would
rder should be adopted in detailing
s experiments on particular sub-
, gums, or resins. A multiplicity
fused mass, without any regard to
neral law, can do little to facilitate
e; the memory cannot retain them,
necessity of operating, as we have
h chemists, with our book resting
rue, these observations are no more
author than to almost every other
be evident to all who either read,
nts: and, as it should be a rule
tem, so it should also be a maxim,
lways to arrange the facts accord-
logy, drawn from just conceptions
operations. The experiments of
em to have been well conceived,
fficient perspicuity and accuracy;
, so numerous as may be necessary
respecting the peculiar principles
lrug.

OF ANTIQUARIES.

ion of a seal belonging to Mary
the museum at Paris, was exhi-
arms of England, against which
with so much ardour, denying
the English arms, and alleging,
her ultimate views on the throne
f Mary was, That her family con-
t to use the arms of her forefathers,
ted by the king of France. Several
were made by the learned secretary
hich it did not appear that Mary's
fficiently established by the usage
ect might again exercise the pen
hly ingenious, but too often fanci-

e Rev. Dr. Hamilton in the chair,
n, supposed to be used by butchers
or the knowledge of iron. It was
onsisted of shaded grayish green
ry compact, except about an inch
square

square near the broad end, that was very porous and rough: it is about 8 inches long, nearly 3¼ inches broad at one end, and 1¼ at the other, both of which are bevelled into a tolerably sharp and circular edge.

A very interesting communication from the director, Mr. Lysons, was read, on the state of the English mint, and coinage of England, during the reigns of the first six Edwards. From these curious items it appeared that this country was principally indebted, in the eleventh and twelfth centuries, to the merchants of Lucca for the current coin of the realm. Lucca was formerly a republican state of Italy, whose merchants then possessed the principal traffic of Europe.

J. B. Repton, esq. exhibited to the society some of his drawings of Saxon architecture, consisting of a capital and base of a Saxon column.

Dec. 19, the right honourable the earl of Leicester in the chair, a medal of Charles I., and a silver seal of the parish of Bow, Cheapside, were exhibited. This seal bears date 1598, as mentioned by Stowe, and consists of the spire of the church as it appeared before the fire of London: it is deemed the only parish seal now in existence that was in use in London before that dreadful catastrophe. In the spire there appear places for lanterns, or lights, to direct the good citizens of London their way through the streets at that period, when lamps, owing to the narrowness of the streets, were much more necessary than at present.

The secretary read a most amusing paper on the history, progress, and final conclusion of the cure of the scrofula, or king's evil, by the royal touch. This mode of cure commenced with Edward the Confessor, and, it appears, terminated with Charles I., who is called the antitype of the Confessor. The monarchs of France, too, claimed and actually practised this gift, which Clovis received from our English kings, one of whom *touched* or *cured* (for they were synonimous terms) 92,000 persons. Some additional means were, however, used; and a gold medal was always hung round the neck of the patient, which, if lost, the disease immediately returned: prayers too were made at the ceremony.

The learned secretary quoted some observations on the nature and credibility of testimony in this case by the bishop of Salisbury, applicable to all historical evidence, and highly worthy of attention. It appears that many medical men attested the truth of these royal cures. We trust that the reverend author will present this interesting ac-

ore convenient form than in the
serve for an introduction to the
ostures.

L ACADEMY.

the academicians was held on
ember, being the anniversary of
following were elected officers

sident; Henry Thomson, John
nce, Thomas Stothard, Richard
gaud, Richard Coſway, and Ed-
ncil.
n Hoppner, Henry Thomson,
m, John Francis Rigaud, Phil.
John Sing. Copley, esqrs, and
ors. John Francis Rigaud, and
s.
g premiums were given to stu-

al to Mr. Douglas Guest, for the
il colours; the subject—bearing
to the camp.
al to Mr. William Tolmach, for
ining Prometheus to the rock.
edal to Mr. William Lockner,
legant villa, with suitable offices,

Lasc. Hoppner, for a drawing of

ames Noch, for a drawing of an

Richard Tomlinson, for a model

J. G. Bubb, for a model of an

William Kinnaird, for a drawing

Mr. James Eames, for a drawing

R PROMOTING THE FINE ARTS.

nced* the preliminary proceed-
of this laudable and most useful

---

l. xxii, p. 88.

institution. Since that time the Shakspeare gallery, held for a term of sixty-two years from lady-day 1805, under a rent of 125l. a year, has been purchased as an exhibition room for the society for the sum of 4500l. An ample fund has been provided by liberal subscriptions from those of the nobility and gentry who are amateurs and encouragers of the fine arts; and the institution has been regularly organized under the patronage of the king. The following are the bye-laws of the institution.

Patron.—The king.
Vice-patron.—The Prince of Wales.

I. *Of the Object of the Institution.*

1. The primary object of the British Institution, under his majesty's patronage, is to encourage and reward the talents of the artists of the united kingdom; so as to improve and extend our manufactures, by that degree of taste and elegance of design, which are to be exclusively derived from the cultivation of the fine arts; and thereby to increase the general prosperity and resources of the empire. It is conceived, that such an institution is of peculiar importance to the united kingdom at the present moment; when efforts are making in different parts of Europe to promote the arts of painting, sculpture, and design, by great national establishments, and thereby to wrest from us those advantages, which can only be retained by a pre-eminence in the fine arts.

2. With a view to this object it is intended to open a public exhibition, for the sale of the productions of British artists;—to excite the emulation and exertions of the younger artists by premiums;—and to endeavour to form a public gallery of the works of British artists, with a few select specimens of each of the great schools.

3. The exhibition is to be exclusively confined to the productions of artists of, or resident in, the united kingdom; and the higher branches of painting, sculpture, and modelling, are to be considered as the preferable subjects of premiums, and of purchases for the gallery. All other works, however, of the above-mentioned artists will be admissible, if deemed worthy.

4. The British Institution being intended to extend and increase the beneficial effects of the royal academy, which has been founded by his majesty, and by no means to interfere with it in any respect, a favourable attention will be paid to such pictures as have been exhibited at the royal

nstitution will be shut up during

blishment are directed, not only
e arts, but to the increase of the
our own professional artists; the
not as a society of artists, but
ubscription will, therefore, be
artists; but their admission will
At the same time, if any artist
be in any one of the classes of
e same privileges of admission
ibition and gallery, as the other
ass; but no one will be capable
mmittee, or of voting as a go-
s to be a professional artist.

he Governors.

he institution shall be vested in
d contributors of 50 guineas, or
he institution, together with such
elected governors as aftermen-
subscribed 50 guineas, or up-
uineas, being governors for life;
ribed 100 guineas, or upwards,
s, their rights being transmis-
es, under the r.strictions after-

he institution shall be vested in
subject to the privileges of the
annual and life subscribers.
have the right of personal ad-
, and of introducing two friends
and gallery.
e capable of any office, employ-
or under the institution, to which
ument, is or shall be annexed.
ay be transferable, with the con-
rs.
of an hereditary governor, his exe-
ay propose to the board of direc-
re and interest in the institution:
proposed shall be a legitimate
child shall be admitted immedi-
son than a legitimate child shall
otional in the board of directors,
to

to elect him or her, or not; and if they do not elect him or her, then they shall pay out of the funds of the institution to such person so proposed, such sum, not less than 100 guineas, as for the time being shall be the qualification of an hereditary governor of the institution.

7. Each governor shall have one vote for every 50 guineas subscribed.

8. Such of the royal family as shall honour the institution by being governors, may vote by proxy.

9. Ladies, who shall be governors, may also vote by proxy.

10. As soon as it shall be found expedient, application shall be made to his majesty, for a charter of incorporation for the institution.

III. *Of the Committee of Directors.*

1. All the affairs and concerns of the institution shall be managed by a committee of directors, to be elected by and from among the governors; and to consist of the president, four vice-presidents, and twelve other members; and three directors shall be competent to business.

2. The president shall be elected annually, and shall preside at the general courts, and at the meetings of the committee of directors.

3. One vice-president and three other members of the committee shall go out annually by rotation; but they may be re-elected, if the annual court thinks fit.

4. The directors shall have power to admit such pictures, statues, and other works of art, as they shall think proper, into the exhibition; and to fix the time of their continuance there upon sale, and to make such orders respecting the admission and sale of pictures, and other works of art, as they shall think fit.

5. They shall have power, from time to time, to make such regulations respecting their own meetings, and the conduct of business therein, as they shall think fit, so as such regulations be not contradictory to the by-laws of the institution.

6. The directors shall have power, with the consent of the visitors, and with the approbation of the governors, to make by-laws for the institution.

7. The directors shall, with the approbation of the governors, fix the hours and times for the opening of the exhibition and gallery, for the governors, honorary members, and subscribers.

8. They shall have power to order tickets of admission,

ey shall deem expedient, to ar-
micians or subscribers.

mittee of Visitors.

tors shall consist of four vice-
twelve other members, to be
the governors ; and three visi-
usiness.
d three other members of this
ually by rotation ; but they may
court thinks fit.
elected annually.
tors shall have the power of in-
exhibition and gallery, and all
n, and reporting their opinion
.
examine the annual accounts of
ereon, and on the state of the
eeting.
wer of consenting to by-laws.
regulations respecting their own
as they shall think fit.
lect their own chairman, and
eir four vice-presidents, and
e twelve other members of the

tion of Governors.

life governor shall be not less
of an hereditary governor, not

lection as a governor, must be
e meeting of directors, and at
rectors the election may take

rnors shall be by ballot, if re-
e elected, unless two-thirds at
vote in favour of his election.
lected shall not pay in his qua-
, or within one kalendar month
absolutely void.
ho shall have paid in his quali-
not be elected, he shall have his
he shall require it at any time
s after he shall have notice that

VI. Of

VI. *Of the annual and other Courts.*

1. The annual court for election of the president, vice-presidents, treasurer, directors, and visitors, and for receiving the annual report of the visitors, shall be held on the Tuesday preceding the 4th of June, precisely at one o'clock, P. M.; and the persons then elected, shall enter on their respective offices on such 4th of June.

2. The ballot for election shall commence at two o'clock, P. M., and continue open till three o'clock; two scrutineers being previously appointed by the chairman, to examine the lists, and to declare the result of the ballot.

3. When, at any election, the votes shall be equal, the chairman shall have a double or casting vote.

4. Special courts may be called by the president, or in his absence by a vice-president, at the request of the committee of directors, or upon the requisition in writing of thirteen governors.

5. No court shall be competent for the transaction of business, unless nine governors be present; and if there shall not be nine governors present, the court may be adjourned for any time, not less than seven days, notice thereof being sent to the other governors.

6. The president, or in his absence one of the vice-presidents, or if no vice-president, one of the governors present, shall preside at the annual and other courts.

7. When, at any court, the votes for and against a question are equal, the consideration of the question shall be postponed till the next meeting.

8. If the business of any court be not completed on the day of the meeting, such court may adjourn from day to day, until the business is completed.

VII. *Of honorary Members.*

1. Honorary members may be elected by the directors, and shall have the privilege of personal admission to the exhibition and gallery.

2. The president of the royal academy, for the time being, shall be an honorary member of the institution, and every other member of the royal academy shall be presented with a silver medal, which will entitle him, or her, to personal admission to the exhibition and gallery.

3. No person shall be capable of being elected an honorary member, except foreign ministers and foreigners of high rank or distinction.

for promoting the Fine Arts.

nual and Life Subscribers.

guineas a year or upwards, or of
in one sum, shall have personal
of introducing two friends each
l gallery.
guineas a year, or of thirty gui-
ave personal admission, and the
friend each day to the exhibition

uinea a year, or of ten guineas in
onal admission to the exhibition

f the Treasurer.

asurer is honorary, and without
o keep any money of the institu-
ut to leave it with the bankers
s.
ums of money, and no other, as
mmittee of directors.
y to the directors, with two pro-
f 5000l. for duly accounting for,
s of the bankers appointed by the
as the directors shall appoint,
to his hands, on account of the

eral cash-book of all his receipts
ll be laid on the table of the com-
heir meetings.
s accounts to the 31st day of De-
lay them before the managers,
eeting in the month of February
ir being audited and laid before
orted to the annual court.

cers of the Institution.

llector, and necessary attendants,
appointed, and their duties and
ors, and reported by them to the

eipt and Expenditure.

ubscriptions of fifty guineas, or
l legacies, shall be permanently
ls. The other moiety, together
s and monies received, shall be
of the annual expenses of the
institution,

institution, and in premiums for young artists; and after retaining what is necessary for payments due, and for current expenses, the surplus shall be annually applied in the purchase of pictures, statues, models, and casts, for the gallery, or in addition to the permanent stock of the institution.

2. No sale, mortgage, incumbrance, or disposition of any freehold or leasehold property of the institution, or of any of its permanent stock shall be made, except with the approbation and concurrence of a general court, summoned with eight days previous notice.

The following circular letter, with an inclosure of the by-laws, and list of subscribers, has been sent round to such persons as were thought likely to promore the objects of the institution:

"The enclosed is submitted to your consideration by the undersigned, who have been appointed a select committee to manage the concerns of the institution, until a committee of directors is elected. Convinced that the pre-eminence, which the imitative arts attained in certain distinguished periods of antient Greece and modern Italy, was produced, not by fortuitous circumstances, but by great and splendid patronage; and persuaded that our own countrymen are capable of the same excellence in the arts, as they have attained in every branch of science and literature, we solicit that they may be encouraged to consider those excellent and immortal examples of the Grecian and Italian schools, as the objects, not merely of imitation, but of competition. In a country where native energy is most abundant, we ask that professional taste and talent, and national patronage, be no longer confined to inferior objects; but that our artists may be encouraged to direct their attention to higher and nobler attainments; to paint the mind and passions of man, to depicture his sympathies and affections, and to illustrate the great events which have been recorded in the history of the world.

"The fine arts are entitled to respect and reward, not simply on account of the innocent and intellectual gratification which they afford, nor merely because they cultivate and civilize the human mind. In a country like our own, they essentially and abundantly contribute to the national prosperity and resources. It must be obvious that the present flourishing state of our manufactures and export trade, is greatly owing to the progress of the fine arts under his majesty's judicious patronage; and that in hardware, cot-

every other article to which the
the British artisan has been ap-
form, and refined elegance of
ted to make our manufactures
orld, and to introduce them into
of political warfare and penal

owever, cannot be retained, but
n of the fine arts. From those
f the country must be cherished
he same time to produce inex-
serve classical beauty and chas-
, in this respect, worthy of ob-
t advance, we must recede; and
rove, we shall begin to degene-
s are of increased importance at
n it appears to be the object of
t establishments for painting and
by the arts of peace, the influence
in war. We feel, however, no
spirit of the British artist will
ed, whenever a free and fair scope
s;—whenever he shall be stimu-
ge as that which raised and re-
Grecian masters;—a patronage,
r to historical evidence, we shall
ce in art has ever been obtained,
ntry.

ons, we beg leave to address you,
f the fine arts, on the establish-
stitution; the principal object
d reward the talents of the artists
d to open an exhibition for the
For the attainment of this object
ssistance and patronage; request-
your directions, in which of the
u will permit your name to be
ve the honour to be,
obedient humble servants,

Abraham Hume.
Francis Baring.
R. P. Knight.
Thomas Hope.
William Smith.
Thomas Bernard."

ONT.

The committee of directors consists of the following governors:

The Earl of Dartmouth, president.

For one year.

The marquis of Abercorn, vice-president.
Lord Northwick.
Sir George Beaumont, Bart.
Thomas Bernard, esq.

For two Years.

The marquis of Stafford, vice-president.
Right hon. Isaac Corry, M. P.
Sir Abraham Hume, bart.
Thomas Hope, esq.

For three Years.

The earl of Egremont, vice-president.
Lord Mulgrave.
Sir Francis Baring, bart. M. P.
Richard P. Knight, esq. M. P.

For four Years.

Lord viscount Lowther, vice-president.
Right hon. Charles Long, M. P.
William Smith, esq. M. P.
Philip Metcalf, esq. M. P.

The committee of visitors consists of the following governors:

For one Year.

The duke of Bedford, vice-president.
The earl Camden.
John J. Angerstein, esq.
John Symmons, esq.

For two Years.

The earl of Bridgewater, vice-president.
Samuel Whitbread, esq. M. P.
Samuel Thornton, esq. M. P.
John Egerton, esq.

For three Years.

The earl of Essex, vice-president.
Lord De Dunstanville.
Charles Duncombe, esq. M. P.
Charles Wall, esq.

For four Years.

The earl of Aylesford, vice-president.
Lord Dundas.
George Hibbert, esq.
Caleb Whitefoord, esq.
William Morland, esq. M. P. treasurer.

MALLEABLE ZINC.

your insertion of the following
having read in your magazine for
Messrs. Hobson and Silvester's
naking zinc ductile or malleable.
stion that the above-named gen-
elves make the discovery of this
am acquainted with one who has
very, I think the public should
s the reputation of first inventor
ingenious man has for his la-
rs ago, Mr. W. E. Sheffield, of
metallurgist), making an assay
rather impatient to examine the
h an intent to break it, while it
lly surprised to find, that instead
g with the usual fracture of zinc,
and when broken (after many
) exhibited a steel-grained fibrous
er his metal was only zinc, he
nd with some that he knew to
result; from which he immedi-
at a certain temperature, was
e other metals. This he found
ing it into wire and laminating
ens of this last, not the 200th
ng the strength and tenacity of
a particular purpose, long before
s. Hobson and Silvester's patent.
n in the habit of furnishing the
ical friends, both at home and
specimens of manufactured and

I am, sir, yours,
W. Lowry.

MISTRY.

ing chemist, has for some time
paring an elementary chemical
m, for the use of schools, and
persons who are unacquainted

the present volume.

with chemical science. And in order to remove in some measure the difficulties which such persons find in acquiring chemical knowledge, we understand that he has observed the utmost simplicity of language and arrangement, and has varied the mode of putting the questions, whenever the subjects seemed to require more than ordinary elucidation. A very copious collection of Notes will be subjoined for the use of the preceptor in explaining the doctrines taught in the body of the work, and for the purpose of pointing out the connection which subsists between chemistry and the arts, and showing the various ways in which the several substances in nature are applied in the manufactures of the country. We understand that he intends to annex a vocabulary of chemical terms, various useful tables, a chapter of amusing experiments, and references to the most approved treatises in every department of the science. The work (now in the press) will be ready for publication the beginning of February. It will be entitled a Chemical Catechism, and will be comprised in one volume, octavo.

GALVANISM.

Doctor Joseph Baronio has published at Milan the description of a Galvanic pile, formed of vegetable materials only. The author cut disks of horse-radish and beet-root of about two inches in diameter; aftewards he prepared equal disks of walnut-tree wood. The latter disks are so raised at their edges as to contain a little solution of acidulous tartrite of potash in vinegar, in which they have been previously boiled, to purge them from the resinous principle which the walnut-tree contains. By forming the pile with sixty pairs of disks, one of horse-radish, the other of beet-root, with disks of wood between the pairs, and in each of these a little of the abovementioned solution, he obtained Galvanic effects, in a prepared frog, of which, by means of a leaf of Cochlearia, he made the spinal marrow communicate with the base of the pile, while by a double band of gray paper, well moistened with vinegar, he made its muscles communicate with the top of the pile.

The description of the apparatus is so clear and detailed, as to prove that the author, who is already known by several productions in physical science, wishes that philosophers and amateurs should repeat his experiment.

For horse-radish and beet-root, the author has already substituted disks of other vegetables with equal success, and he flatters himself that these will serve to extend the application of Galvanism to universal ve-

e been made conformable to the
andi, viz. that there is a deve-
often as there is a change of
tation in bodies, and to those of
sors Vassalli-Eandi and Balbis,
effects from plants by applying
and the roots; the experiments
e to those of professor Rossi,
s Galvanic piles with vegetables,
lants and with animals, especi-
out the intervention of any me-
th several others made by the
e induced some philosophers to
fluid is one of the component
d through all bodies in nature,
by the chemical action of sub-
osition, and that it concurs with
e natural fluid to the formation
es.

RONOMY.

sion and Declination of Ceres,
o, for January 1806.

	Juno.	
c. N.	A.R.	Dec. S.
′	h m s	° ′
9 15	11 41 52	2 37
9 31	11 42 52	2 37
9 46	11 43 44	2 36
0 0	11 44 24	2 33
0 13	11 44 48	2 28
0 25	11 45 0	2 21
0 35	11 45 0	2 12
0 45	11 44 44	2 2
0 53	11 44 16	1 49
1 0	11 43 32	1 35

low to be seen.

NEW COMET.

On Sunday the 8th of December, about six o'clock in the evening, Mr. Firminger, the assistant at the royal observatory, Greenwich, discovered a comet in the constellation Aquarius, a little to the east of south. Its appearance to the naked eye was similar to a star of the first magnitude, when covered by a cloud, through which it might be faintly seen; or rather like what Jupiter would appear under similar circumstances: but when viewed through a night-glass, it appeared to have a bright nucleus surrounded by a coma.

As it was approaching the meridian when first discovered, Mr. Firminger made preparations to take its transit, and found that its light was sufficiently strong to enable him to illuminate the wires in the focus of the telescope, so as to observe its passage with great accuracy.

The mean time of its transit was $6^h\ 24'\ 7''$, with right ascension $11^s\ 23^\circ\ 6'\ 49''$, and south declination $23^\circ\ 41'\ 8''$.

On the following evening it was looked for again; but though the sky was very clear, it could not be seen. It is therefore very probable it may be moving towards its perihelion, and should this be the case, astronomers may expect to find it again in its return from the sun.

The same comet was, we understand, observed by Dr. Herschel, at Slough, near Windsor, about the same time that it was discovered by Mr. Firminger.

COMPOSITION OF MURIATIC ACID.

In our present number (see page 257) is inserted a third communication from Mr. Peel of Cambridge, on the production of muriatic acid and alkalis, by the decomposition of water. Here we have to state the result of an experiment on the same subject by another gentleman.

By continuing to pass the Galvanic fluid from a trough holding about forty pair of square inch plates through distilled water contained in a glass tube, furnished at one end with a wire of gold, and at the other with a wire of platina, at length a coating of oxide of gold was deposited on the gold wire—evidently proving that oxygenated muriatic acid had been formed by the process.

If we are rightly informed, this experiment was performed by Mr. Cuthbertson—as fit a person as any in the world for experiments of this sort.

R THE DROPSY.

as been received by the editor of
n Mr. T. H. Shrimpton, governor
at Faringdon, dated August 30,
few weeks since I observed that
to be eaten, was recommended as
l as I had a pauper in the house
experiment, and, to my astonish-
stant relief. I repeated the dose
n, in the course of a week, was
ng, and will begin reaping for me
r continues fine. The woman's
, and her age is 62 years."—The
s follows :—Infuse two large tea-
a quart of water: let the decoc-
lay, and the leaves eaten at short

its appearance in different news-
the good effects of the prescrip-
—A woman in Anderston, in the
, who has been afflicted with a
the month of June, has received
a fair prospect of a cure, from
tea.

IOGNOMY.

graphic lecturer, is now giving
counts among his approvers in
hers Kallisin, Scheele, Fenger,

HE EDITOR.

ith a friend, and being asked the
weet after being frosted, I found
to give a satisfactory answer. If
s, through the medium of your
e a rational description of the
t of cold disengages the saccha-
more particularly than of other
much oblige a constant reader,
l to some more important pur-
economy.

LIST OF PATENTS FOR NEW INVENTIONS.

To John De Lafons, of Threadneedle-street, in the city of London, watchmaker; for a marine alarum chronometer, for ascertaining the time of a ship's log line running out, the time of the watches on ship board, and many other useful purposes. Dated November 19.

To George Wyke, of Winsley, in the county of Wilts, esq.; for a method of working pumps of various descriptions by machinery, whereby much manual labour will be spared. Dated November 19.

To Richard Brown, of the parish of St. Botolph, Bishopsgate, in the city of London, cabinet-maker; for improvements in the construction of several parts of tables, and of various other articles of household-furniture, which stand upon or are supported by legs or feet. Dated November 26.

To James Ingram, of Castle-street, in the city of Bristol; for a new method of manufacturing powder sugar from raw sugar alone, and from the mixtures of raw sugar and syrup of sugar. Dated November 26.

To Samuel Annoss, of Red-Lion-place, in the parish of St. Sepulchre, in the city of London, china enameler; for improved methods of preparing various enamel colours, and of applying the same so prepared to the ornamenting of useful vessels of glass. Dated November 26.

To Joseph Steel, of Stockport, in the county of Chester; for cloths, fustians, calicos, cambrics, lawns, striped cotton, and other articles manufactured with cotton, wool, and flax, mixed and spun together. Dated December 17.

OLOGICAL TABLE
EY, OF THE STRAND,
ecember 1805.

Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather
30·12	7°	Foggy
29·90	8	Fair
·50	5	Showery
·25.	0	Rain
·19	0	Rain
·75	15	Fair
·91	0	Rain
30·00	0	Rain
·25	10	Fair
·15	6	Cloudy
29·90	0	Rain
·80	12	Fair
·19	0	Rain
·20	6	Fair
·55	10	Fair, with sn at night
·30	5	Cloudy
·60	10	Fair
·59	0	Snow
·80	5	Cloudy
30·12	11	Fair
·38	7	Cloudy
·25	6	Cloudy
29·92	8	Rain
·50	0	Rain
·03	0	Rain
28·85	6	Fair
29·50	6	Fair
·65	7	Fair
·74	0	Rain
28·95	0	Rain

ter's height is taken at noon.

---

r, page 108, line 10, for Plate IV
late V. read Plate IV.

LV. *Abstract of Observations on a diurnal Variation of the Barometer between the Tropics.* *By* J. HORSBURGH, *Esq.* *In a Letter to* HENRY CAVENDISH, *Esq.* *F.R.S.**

SIR, Bombay, April 20, 1804.

WHEN I was in London at the conclusion of the year 1801, I had the pleasure of being introduced to you by my friend Mr. Dalrymple, at which time he presented you with some sheets of meteorological observations, with barometer and thermometer, made by me in India, and during a passage from India to England.

Being of opinion that few registers of the barometer are kept at sea, especially in low latitudes, I have been induced to continue my observations since I left England, judging that, even if they were found to be of no utility, they might at least be entertaining to you or other gentlemen who have been making observations of a similar nature.

During my last voyage I have employed two marine barometers, one made by Troughton, the other by Ramsden; and a thermometer by Frazer. These were placed, exposed to a free current of air, in a cabin where the basons of the barometers were 13 feet above the level of the sea.

The hours at which the heights of the barometers and thermometers were taken, viz. noon, four hours, ten hours, twelve hours, sixteen hours, and nineteen hours, were chosen, because at these times the mercury in the barometer had been perceived to be regularly stationary between the tropics by former observations made in India in 1800 and 1801. It was found that in settled weather in the Indian seas, from eight A.M. to noon, the mercury in the barometer was generally stationary, and at the point of greatest elevation; after noon it began to fall, and continued falling till four in the afternoon, at which time it arrived at the lowest point of depression. From four or five P.M. the mercury rose again, and continued rising till about nine or ten P.M., at which time it had again acquired its greatest point of elevation, and continued stationary nearly till midnight; after which it began to fall, till at four A.M. it was again as low as it had been at four in the afternoon preceding; but from this time it rose till seven or eight o'clock, when it reached the highest point of elevation, and continued stationary till noon.

Thus was the mercury observed to be subject to a regular elevation and depression twice in every twenty-four hours

---

* From the *Transactions of the Royal Society* for 1805.

e lowest station was observed to
in the morning and evening. I
y never remained long fixed at
a regular tendency to rise from
n the morning and about nine in
se times continued stationary till

weather, especially at Bombay
ular ebbings and flowings of the
ceived; but a tendency to them
ble when the weather was more

formerly presented to you were
l depressions twice every twenty-
pics, in steady weather, as had
assan and Peyrouse, by Dr. Bal-
rs. But since my last arrival in
the atmosphere appears to pro-
the barometer at *sea* from what

her this phænomenon has been
re, I will here give you an ab-
ing how the barometer has been
ole time since I left England,
form an idea whether I am right
meter is really differently affected
shore, at those places in India
been made.
with the observations made on
from London towards Bombay,
May 1802.
the Land's End, April 19th, the
barometers was fluctuating and
atitude 26° north, longitude 20°
mercury in barometers then be-
ing two elevations and two de-
r hours, (which for brevity in
ill call equatropical motions.)
o latitude 10° north, the differ-
stations of the mercury in the
at as it was from latitude 10°
and from thence to latitude 25°
mentioned limits the difference
the mercury in the barometers
rally from five to nine hundred
daily and nightly motions.

When we reached the latitude of 28° south, longitude 27° west, June 7th, the mercury in barometers no longer adhered to the equatropical motions; but then, as in high north latitudes, its rising and falling became irregular and fluctuating during our run from latitude 28° south, longitude 27° west (mostly between the parallels of 35° and 36° south), until we were in latitude 27° south and longitude 51° east, on the 11th of July. The mercury then began to perform the equatropical motions, and continued them uniformly during our run from the last-mentioned position, up the Madagascar archipelago, across the equator, until our arrival at Bombay July 31, 1802.

August 6th, 1802. When the barometers were placed on shore in Bombay, the mercury, for the first six days, appeared to have a small tendency towards performing the equatropical motions, but not equally perceptible as when at sea, the difference between the high and low stations of the mercury in the barometers being great to the day we entered the harbour of Bombay. From the 12th of August to the 22d, the mercury could not, in general, be observed to have any inclination to perform the equatropical motions, although, at times, a very small tendency towards performing them might be perceived.

On the 23d of August the barometers were taken from the shore to the ship. Immediately on leaving Bombay harbour, August 26th, 1802, the mercury in the barometers performed the equatropical motions, and continued them, with great uniformity, during our passage down the Malabar coast, across the bay of Bengal, in the strait of Malacca, and through the China sea, until our arrival in Canton river on the 4th of October. When in the river, the mercury became nearly stationary during the twenty-four hours, except a small inclination at times towards the equatropical motions, but they were not near so perceptible as at sea; this change taking place the day we got into the river.

During our stay in China, the barometer on shore, at Canton, had very little tendency towards the equatropical motions throughout the months of October and November that we remained there. At times, while in China, a small inclination towards performing the equatropical motions appeared; but, as in Bombay, the difference of rise and fall was of so small a quantity as to be frequently imperceptible.

December 2d, 1802. On our departure from Canton river the equatropical motions were instantly performed by the

mercury.

regularity continued during the
ombay, until our arrival in that
uary 1803.

barometers were placed on shore,
e smallest degree subject to the
ough, with great regularity, they
at sea, even to the day we en-
the barometers was left on board
that on shore, seemed to have
uatropical motions. During the
Iarch, in Bombay, the mercury
oughout the twenty-four hours.
f March the mercury seemed to
ropical motions in a very small
nonth of April, and to the 20th
cy of the mercury to perform the
, but was hardly discernible, the
nall a quantity. From the 18th
May the mercury in the baro-
tionary, except a very small ten-
pical motions at times. At other
tmosphere disturbed the mercury
n: but this was seldom the case,
ather season, or north-east mon-

on the 23d of May 1803. The
arbour the mercury in the baro-
equatropical motions with great
nce between the high and low
ble during the whole of the pas-
a few days in the eastern parts of
land lay contiguous on each side
een the high and low stations of
so great as in the open sea. On
tering the China sea, the equa-
formed in greater quantity, and
our passage up the China sea,
then entered Canton river, and
f the mercury in barometers en-

ember 7th, the barometers were
, during which time the mercury
ncy towards performing the equa-
nclined to a stationary position,
changes of weather. After the
m Canton to the ship, we were
four

four days in getting clear of the river, in which time the mercury inclined to be stationary, excepting that a small inclination towards the equatropical motions seemed to evince itself at times. But no sooner had we cleared Canton river, September 13th, 1803, than the mercury in the barometers began to conform to the equatropical motions, of two elevations and two depressions every twenty-four hours, at equal intervals of time, (although we were near the land until the 15th of September.) And the mercury, with great regularity, continued to perform the equatropical motions from September 13th, 1803, the day we cleared the river of Canton, until October 13, when we entered Sincapore strait, excepting a small degree of irregularity, which affected the mercury on the 22d of September, when it blew a gale on the coast of Isiompa.

October 13th, 1803. On entering the strait of Sincapore, which is about three leagues and a half wide, the mercury in the barometers was then a little obstructed, and did not perform the equatropical motions in the same quantity of rise and fall as when we were in the China sea. But on the following day, October 14th, when we had passed the narrow part of the strait, the mercury conformed to those motions with regularity until October 21st, when we arrived in the harbour of Prince of Wales's Island: then a great retardation took place in the equatropical motions; for, during the time the ship remained in the harbour, from October 20th to November 5th, 1803, the mercury in barometers seemed only in a small degree subject to them, the difference between the high and low stations of the mercury being in general not more than half the quantity that takes place in the open sea, or at a considerable distance from land. Where the ship lay at this time in the harbour, the land, on one side, was a full quarter of a mile distant, and on the other side about a mile and a half.

On November 5th, being clear of the harbour of Prince of Wales's Island, the equatropical motions were instantly performed by the mercury in the usual quantity experienced at sea, which continued with uniformity until December 3d. On this and the following day the mercury fell considerably during our passage over the tails of the sands at the entrance of Hoogly river in latitude 21° 06′ north; and on December 5th, the day of the moon's last quarter, a gale of wind commenced from north-north-east, with much lightning and rain in the night. During the latter part of this day the mercury began to rise, and there soon followed a change of settled weather. When we were in the lower part of

eared to conform in a small de-
motions; but when well up the
ur, the mercury inclined to be
e twenty-four hours, as has for-
ppen in Canton river, Bombay

, after we had cleared the river
he barometers began to perform
ity, which continued during the
r arrival there on February 12th.
n placed on shore, the mercury
ition, without evincing any pro-
opical motions from the 12th to
, as has been noticed in the fore-
en frequently on entering a har-

the meteorological journal ceases,
the observations of twenty-two
ed April 6th, 1802, in Margate

of sending you this abstract from
apparent difference of the mer-
a, from what has been observed
mentioned in the preceding de-
seen any account indicating the
t might be interesting to you, or
yal Society, to forward this im-
l itself being too cumbersome to
as I am in expectation of return-
s from China next season, I hope
nt you with the meteorological

I am, &c.

J. Horsburgh.

e foregoing abstract I have re-
iend Mr. Dalrymple, intimating
ological journal itself would be
uced me to transmit to him the
uest to deliver them to you. I
d leisure time to make out a fair
in place of the original sheets in

LVI. *An*

LVI. *An experimental Inquiry into the Nature of Gravelly and Calculous Concretions in the Human Subject; and the Effects of Alkaline and Acid Substances on them, in and out of the Body. By* THOMAS EGAN, *M.D. M.R.I.A.*

[Continued from p. 212.]

THESE facts being pretty well established and acknowledged, it is time to inquire how far we may account for them; and whether experiments, instituted out of the body, may not throw some light on this subject. Dr. Saunders, in a letter to Dr. Percival, (Percival's Essays, Medical and Experimental, vol. iii.) on the subject of carbonic acid as a solvent of calculous concretions, observes, "If a more powerful and active solvent than any hitherto known shall be discovered, it is highly probable that such a discovery can only be made by a rational and chemical inquiry into the powers of different bodies of combining with the contents of the urine, and preserving them in a fluid state out of the body." Now, on the other hand, we may presume, that whatever substances cause a separation or precipitation of uric acid, in an aggregate state, from healthy urine, will give rise to these disorders. For we are not to forget that the uric acid, which forms so large a proportion of calculous concretions, and the entire of the gravelly, is a natural secretion from the blood, performed by the functions of the kidneys, and excreted by the urine, and can only be prejudicial by a previous morbid separation from it within the body. With this necessary view of the subject before us, (for which we are, as already observed, indebted to Boerhaave,) I resolved to try, 1st, What might be the effects of acids of different kinds on healthy urine, as to their influence in causing this same previous precipitation; and, 2dly, that of alkaline substances in preventing it. And here it must be observed, that to draw any satisfactory conclusions from experiments made with these substances out of the body, we must suppose they reach the kidneys and blend with the urine, still possessing their relative distinctive properties; and that this takes place, we have every reason to presume. Doctors Percival and Saunders, Mr. Bewley, and others, have ascertained the presence of carbonic acid, in an uncombined state, in the urine of those who drank the mephitic water for some days: an acid certainly foreign to its recent healthy state; for, after repeated trials, by heating it to nearly ebullition in one of Priestley's air bot-

the separation or transition of a
acid into a jar of lime water.
:hes the kidneys undecomposed
ve less difficulty in believing the
o so. That the tartarous acid in
idulous tartarite of potash exerts
unctions of the kidneys, is well
: is at the same time rendered
ly ascertained by the usual tests.
f the other vegetable acids, which
wers, and increase the natural
nnæus, in his second volume of
æ, De Genesi Calculi, already
ing made the following experi-
le says: "Hisce diebus ipse ex-
urina; hæc communiter a solu-
dum rufescit; at si libram unam
vel alterius vini acidi hauserim,
es, valde rubra et rutilans evadit
lacmus; certo indicio, acidum
sse, et urinam infecisse." Nor
hese energetic substances should
eys, when we find so many mild
I will not mention the commu-
rinciple as odour, but will more
of colour. Rhubarb, turmeric,
ubstances, so completely impart
t they would appear to be very
uice of the beta vulgaris, a mild
ous class, so deeply reddens it as
for bloody urine, of which a
in my practice.
s, it has been at all times known
heir properties to this excremen-
ance in the use of the *aqua kali*
days, even in small doses, con-
alkaline state; and we have every
e same takes place with the car-
in so much larger quantities.
xperiments made in London and
t impregnation of the urine was
on and precipitation of the acidu-
pon the addition of the tartarous
al of experience in these matters,
arbonates the dose must be con-
case in London,) and continued
for

for some time, having frequently given two scruples of desiccated soda (containing, according to Mr. Kirwan, 23·94 grains,) in the twenty-four hours, for some days together, without any diminution of the usual acidity of this liquor.

For the information of such of my readers as may not be of the medical profession, I must here observe, that physicians distinguish two kinds of urine: the one rendered immediately after meals, and much dilution, before the process of digestion, or state of sleep, can take place; always more or less limpid; being comparatively less charged with the natural component parts of urine, (the urée, or extractive colouring matter, in particular,) and called *urina potus,* to distinguish it from the *urina sanguinis,* rendered many hours after meals and sleep, the taking no more than a necessary quantity of liquids, and containing the usual proportion of saline and other ingredients; more especially the urée, to which it owes its natural citrine colour.

This last, therefore, was that employed in the following experiments, if not otherwise specified; with the chemical history of which I must suppose gentlemen of the profession now tolerably well acquainted, being so fully and accurately detailed in the tenth volume of the *Connoissances Chimiques.*

Having, in the preceding pages, insisted so much on the acids and acescent drinks as occasional causes of these complaints, the first object seemed to be, to ascertain whether the urine of those most subject to them, or actually labouring under them, was more relatively acid. We have already seen, from a register of these patients, kept for forty years in the hospital of Luneville, that the early period of life, from two to six years of age inclusive, is most liable to calculous affections. Now, the urine of healthy children is always found more acid than that of adults, generally in the proportion of two to one. Whilst several drops of the latter are requisite to redden a given quantity of infusion of litmus, a single drop of the former turns it to a clear red. Paper stained with an infusion of turmeric, and reddened by an alkali, was immediately restored to its colour by a single immersion in the urine of children; an effect which required some time in that of adults. And that this should be the case we shall not be so much surprised at, when we consider the nature of their diet; and that, in addition to the phosphoric and uric, their urine contains the benzoic acid in considerable quantity, the proportion of which is found afterwards progressively to diminish with their advancement in life.

The

ty I have of attending to those
, that the urine of gravelly pa-
, nay, after standing many hours,
degrees, is relatively more acid
es as much so as the gouty; and
ven after depositing its gravelly
his, however, sometimes occurs
e depositing copiously this acid
ing no increased, but sometimes
; for with them a considerable
y of the usually excreted super-
often takes place, as shall be
er occasion.

observations, it is now time to
substances are productive of,
ody, with this very complicated
vent repetition, I will observe,
s rendered fresh in the morning,
ee to four ounces, (unless other-
most easily retained at one time
tity of acid extremely small, for
m increasing its acescent pro-
e usual tests) beyond what fre-
f those who use acescent drinks,
r gravel. A standard quantity
mparison; and the temperature
degrees, being in autumn 1799.
table acids:—

eriment I.

rine of an adult was added one
s acid, which, like every other
change in it; but in a very short
down to the temperature of the
ly minute shining spiculæ, ob-
re seen floating in it: these gra-
r and size, began to reflect the
fectly transparent, soon became
the usual cloud, or *nubecula*,
adhere to the sides of the glass,
n in the shape of small bright
rd, after twelve hours, nothing
sual *nubecula*; nor was there any
paration of uric acid, even after

Experiment

Experiment II.

To the same quantity of adult urine were added one drachm and half of acetous acid, which caused a more copious separation and crystallization of this substance with the foregoing appearances. None observable in the standard after twenty-four hours.

Experiment III.

To four ounces of urine of a healthy child, who never was observed to pass gravel, and of the usual degree of acidity, was added one drachm of acetous acid, which soon caused an evident and copious separation of crystallized uric acid. The crystals were, however, not quite so coloured; the urine of children not being so much impregnated with the urée, or colouring matter. No such appearance in the standard after twelve hours or more.

Experiment IV.

To four ounces of adult urine, rendered very soon after a tea breakfast, and nearly in a state of *urina potus*, was added one drachm of acetous acid. After three hours, a crystallization of minute sandy particles took place. None in the standard, even after three days.

Experiment V.

Thirty drops only, of acetous acid, were added to four ounces of the urine of a gouty patient æt. sixty, and who sometimes felt some slight gravelly tendency. A very copious precipitation of this matter quickly took place. Some observable in the standard, also, the next day.

Experiment VI.

To three ounces of healthy adult urine were added a few drops only of citric acid. A distinct crystallization, but extremely minute, took place. No appearance of any in the standard after many hours. The experiment was repeated with one drachm of filtered citric acid, which only hastened the separation and increased the quantity of crystalline matter.

Finding, by these experiments, and numberless others, with a detail of which it would be unnecessary to take up the time of the academy, that the acetous and citric acids, blended with the urine, separated its uric acid in a crystallized state, I thought it might be interesting to investigate what the effect of the tartarous acid might be, being that which, in an uncombined and partly combined state of acidule, as in

of potash, chiefly prevails in the
e countries most subject to these

riment VII.

hy adult urine were added some
is acid. To the same quantity
l, which brought them nearly to
lity; a circumstance always at-
ve trials with different acids. In
the crystals were not only larger
exceeded in quantity any thing
with the acetous acid, a much
te crystals took place.

iment VIII.

were added two drachms of a
us tartarite of potash of the tem-
usual separation and crystalliza-
portion: the crystals, however,
loured, than those with the un-
The two last experiments, fre-
l the same results.

riment IX.

experiments having led to some
s of the carbonic acid gas, so
mended by doctors Percival and
more modern alkaline combina-
l as super-aërated soda waters:
f Nooth's apparatus were intro-
rendered healthy urine, and ex-
nic acid gas. After a few hours
ecipitation of uric crystals took
e constant agitation from the
us bubbles,) larger than any I
the tartarous acid excepted. In
stinct crystallization, even after
the same experiment afforded

riment X.

id gas productive of similar ef-
itherto examined, it was natural
bination with the portion of al-
our mephitic and soda waters,
it, may prevent a separation of

Half an ounce only of the common soda water of the shops, prepared by Mr. Kinsley, was added to four ounces of healthy urine. A similar quantity was impregnated with carbonic acid gas. In the former, after forty-eight hours, or more, no more than the usual nubécula; nor could a single crystal be discovered even by a magnifier. In the latter, an early, copious, and beautiful crystallization. On the result of this experiment, frequently repeated, with various proportions of the mephitic alkaline water, I shall afterwards have occasion to make some remarks.

Though the mineral acids, in an uncombined state, enter not into the matter of our diet, and are no longer considered as lithontriptics, since the notion of the earthy nature of these concretions has been abandoned; yet, as they are sometimes prescribed with other indications, I thought fit to extend my researches, though in a summary way, to them also.

Experiment XI.

To sixteen ounces of urine were added eight drops of very dilute sulphuric acid. To a similar quantity, two scruples of citric acid, to bring them to nearly the same standard of acidity. After a very short interval, in that with citric acid, the usual appearances of transparent floating moleculæ reflecting light, and gradually becoming larger, were observed, and began to adhere to the glass; whilst in the other, after five hours, no such appearances took place. Yet, after forty-eight, here also a precipitation took place of smaller crystals, and less in quantity; for, being collected on a filter, and carefully dried, they weighed only two grains, whilst the former amounted to three. And this is nearly the largest proportion I ever found the above quantity of healthy urine to contain.

Experiment XII.

As the nitrous acid is one of the most active solvents of this matter, out of the body, I was curious to ascertain, whether, in the very dilute state in which it must reach the kidneys and bladder, (where its action must have been facilitated by the actual state of solution of this substance,) it would manifest its powers in preventing its separation.

To three ounces of urine, rendered a few hours after breakfast, and, of course, scarcely acid, were added five drops of weak nitrous acid, which did not seem to add very materially to its acescent properties.

To a similar quantity were added four scruples of acetous acid.

ur the former deposited a distinct
r in considerable proportion. This,
e surprised at, when we consider
d in that fluid may be determined
the latter the separation did not
le time after. We see, then, that
and powerfully precipitates this

riment XIII.

, showing a strong acescent qua-
ree drops of strong marine acid.
rent granular precipitation took
mation of extremely minute gra-
even after two days standing, did
as that with vegetable acids. This
n some action of this acid upon
atter; but as to the smallness of
y depends upon the more speedy
em down before they can assume
ving but a shade of difference be-
pulverulent deposits.

riment XIV.

we are satisfied that the vegetable
premature separation and crystal-
ents of recent healthy urine; but
is only takes place under circum-
ble to the living system, viz. a
, and, in some instances, a con-
e air; two powerful promoting
general, but more especially of
o determine, therefore, this most

out recent urine (in a well closed
ops of very dilute nitrous acid,
sand bath: temperature varying
ees at most. The same quantity,
but without addition, was laid
a standard: temperature 56 de-
t interval indeed, and almost as
the temperature of between 80
ing granular particles were ob-
began gradually to settle upon a
rather nubeculæ, and to acquire
arried up and down the liquor,
gitation. This experiment again
twice

twice latterly repeated, and always with the same result, (care being taken to keep the temperature, as nearly as possible, for a few hours, between 90 and 100 degrees,) afforded one of the most pleasing objects imaginable, viz. the formation of this crystalline matter, under all the disadvantages of elevated temperature and constant agitation, from (I may almost say) their primordial moleculæ to the accomplishment of their full size. And here, indeed, they are most beautiful, and not to be distinguished from those spontaneously deposited.

The whole experiment strikes us strongly with a semblance of what probably passes, under similar circumstances, in nature; and reminds us of the danger attendant upon acid impregnations, more particularly at bed-time, when the urine, by many hours retention and quiet, has ample time to deposit its uric acid contents in the bladder. From it also we learn, that the temperature of the human body, in place of retarding or preventing (as might be expected *à priori*) these pernicious effects, rather promotes them, and that to a considerable degree.

But whilst we endeavoured to establish this point, from practical observation as well as experiment, we seem to have entirely forgot that the urine itself is an acid liquor, and that therefore, if acids were so prejudicial, it is not probable that the provident wisdom of nature would commit the discharge of this necessary excretion to a fluid, which, by prematurely separating it within the body, would completely defeat the object of her humane attention. And would she not, in the infinity of her resources, dispose of it by some less objectionable emunctory?

I would, in the first place, observe, that though healthy urine manifests the properties of an acid liquor, it is in the very smallest possible degree; so much so, that though mentioned long since by Moraung, Coldevillars, and other surgeons, yet it was not, either chemically or medically, acknowledged to be so, until the time of Scheele, who finally established this point, as well as the nature of the prevailing acid. And, secondly, that nothing can be more erroneous than the opinion, which so long prevailed, that the phosphoric acid existed in it in a naked or uncombined state. It is now well established that it is only in that of a weak acidule, or acidulous phosphate of lime, very little short, indeed, of the point of saturation; and hence the weakness of its action as an acid liquor: for were it not for itmus, and some of the more delicate of the vegetable blues, we should have been, even to this day, ignorant of this

le, indeed, that it will often not
cabbage, whilst it turns with lit-
feebly, with this most delicate of
op of phosphoric acid was added
ater. Of this weak acid impreg-
ent to turn the infusion of litmus
neral acids do; whilst seven of
weak effects of acidity, and re-
w any. If the urine, therefore,
standard of acidity, we have no-
here, indeed, we must again ad-
m of Providence. The occasion
so, and that, too, before so com-
uired some chemical discrimina-
carefully provide for the expul-
part of the osseous fabric, which
f the system; but as this salt is
hicle, such as the urine, nothing
to obviate this difficulty than a
ration, or state of acidule, which
vide for its solubility and its eli-
hus far, whilst it attended to one
have entirely forsaken its charge
to this fluid; and by this degree
pitate, retain in the system the
frequent an occurrence of gra-
ints, amongst mankind in gene-
the gouty. It therefore prudently
of acidulous phosphate of lime,
ut of the body, was sufficiently
its temperature. Nay, even for
a degree of latitude to this tem-
narrow and confined indeed, is
but where it precisely terminates
ed to say, though so easily de-

nt, consider how far any morbid
thy standard (which sometimes
on this subject. The most con-
nted with, occurs in the instance
wards the decline of the parox-
is, though in a turbid state, af-
ith an energy equal, or perhaps
ngest acetous acid; and requires
sed proportion of lime water to
reasons. This we find always
depositing,

depositing, sometimes from the bladder itself, but generally before it has entirely parted with its natural temperature, a very large proportion of a reddish brickdust-like sediment (a welcome harbinger to gouty patients), gradually declining, and keeping pace with the alleviation of symptoms, and the progressive return of the urine to its natural degree of acidity. This sediment, Scheele, Bergman, and Fourcroy, consider of the uric acid kind: and so it (but in part only) undoubtedly is, being in a smaller proportion than they were aware of. For, considering that the enormous quantity, rendered in a few days, was incompatible with the known minute proportion of this acid matter in urine, I was determined to make the following experiment:—To a considerable quantity of it, desiccated and well edulcorated with distilled water, were added three ounces of a weak alkaline lixivium; which, after a few hours digestion, completely discoloured it, acquired a golden yellow colour, a sweetish taste, and, on the addition of a few drops of dilute marine acid, precipitated a copious sediment of whitish, minute, needle-shaped crystals, of a silky appearance.

To this precipitate, well edulcorated, was added, by degrees, about one ounce of weak nitrous acid, which acted on it with effervescence, and nearly took up the whole. This solution, being set to evaporate, began to redden the fingers, and other animal matters; no doubt, therefore, could subsist as to its nature. To the remainder, which seemed very little diminished, and only deprived of colour, were added two ounces of dilute marine acid, which, after some time in digestion, nearly dissolved the whole; and finding this acid solution precipitate with lime water, oxalate of ammonia, and fixed alkali, it must have been phosphate of lime. This forms, then, by far the largest proportion of the gouty sediment, which is coloured by the precipitated uric acid. Such also is the result of Crookshank's experiments; and so we should expect to find it, as I shall endeavour to point out, on a future occasion.

Let us now consider how far these analytical results may be confirmed in the synthetic way, having resolved that experiment, as far as applicable, should form the basis of any opinions offered in this essay. The phosphoric, being the native acid, prevalent in urine, it was interesting to determine, whether, by the artificial super-addition of it, so as to bring this fluid to the standard of the gouty, we might not produce effects somewhat analogous to what occur there.

were divided into three equal
d five drops of sulphuric acid;
he third, fifteen. In the first
covered minute floating mole-
he crystalline form, &c. as so
the second, the same appear-
and copiously produced. But
as to excite my astonishment.
xtremely minute crystals which
the phial, the bottom appeared
rystalline and red pulverulent
proportion, and probably pre-
by its hasty deposition. Here,
on of calcareous phosphate and
(which always takes place in
pected here,) would seem only
synthetic approximation to the

of deposited uric acid in this
picion that the phosphoric acid
ith some of the principles of
ive rise to some artificial forma-

herefore, of No. 3, were again
h in twenty-four hours caused
ery few crystals only. It was
eight drops more added; but
rance of a single crystal after
acid, then, only more effectually
e separation of the quantity na-
its more divided pulverulent ap-
ly to its volume.
lemonstrate the identity of these
e naturally deposited matter of
ld not be well mistaken for any
mine; yet, as external charac-
of a Romé de Lisle, or an abbé
wing, and concluding one, on
tituted.

iment XV.

artificial gravelly matter was gra-
nitrous acid, which acted on it
solved the whole, with the ex-
ting, succulent, animal particles,
an.

The evaporated solution reddened the skin, and, after some time, deposited crystals of oxalic acid; as happens in all concentrated nitrous solutions of calculi of the uric acid kind. To another small quantity was added some pure alkaline lixivium, which very soon took it up, became coloured, sweetish, and deposited the usual silky crystalline sediment upon the addition of acetous acid. No doubt, therefore, could remain, as to its identity with that naturally deposited.

And here, though irrelevant to my present object, and merely with a view to excite the attention of the faculty, may I be permitted to ask, how it happens, that in the very worst kinds of typhus fever there is very little diminution of the secretion or excretion of the acidulous phosphate of lime? as appears by the acidity of the urine, lime water, and the quantum of precipitate afforded by the oxalic acid; whilst a very considerable one of the uric acid takes place, and continues so until nearly the termination of the disease, when it begins gradually again to manifest itself; first, by the usual tests only, but presently, upon the crisis taking place, in such quantity as to become insoluble; and therefore quickly precipitates (with some additional mixture of calcareous phosphate and animal mucilaginous matter) under the form of our critical sediment or deposit? or, are we not here again to admire the wise œconomy of the Author of nature, which, by keeping up the considerable and necessary bony excretion of the system, prevents the dangerous accumulation of it which must ensue from its retention during the long protracted period of many fevers? I might here offer some conjectures in explanation, but will reserve them for another place.

Having already trespassed so much upon the indulgence of the academy, I shall here content myself with briefly stating, that, from the above experiments and observations, we may presume to say acids of every kind are prejudicial, and give rise to the formation of gravelly and calculous affections, by causing a separation and crystallization of the lithic acid contents of the urine within the body; not pretending, however, to deny the existence of other causes inherent in the system itself, occasionally productive of similar effects, as has been already observed.

I shall now proceed to the second part of this inquiry; namely, how far, or in what manner, alkaline matters are conducive to the alleviation of these complaints.

[To be continued.]

Pollock, *Esq. of Mountains-*
erend Dr. Lyster, *respecting a*
rmed on a Heifer *.

communication may be thought
society.
fine heifers of the long-horned
of them lately was seized with
, attended with a difficulty of
t difficulty in swallowing; both
d, notwithstanding the applica-
he experienced herds and people
putation of skill in curing those
e liable: in a few days the heifer
nd, being considered as incura-
her throat opened, and found
, or polypus, had grown some-
he tongue, to the size and nearly
ave that it had plainly a neck or
nd that this polypus had nearly
and windpipe of the animal;
escence was in a general state of
good deal the loss of the heifer;
was much concerned to observe
of the same breed and age, (now
covered exactly the same sym-
grew worse, being scarcely able
ll kind of food. I had heard of
ing out a polypus from the hu-
ermined to try the experiment
rpose I threw the animal down
her legs, and got sufficient as-
ead, I opened, under the inser-
ssage by the side of the wind-
roat (taking great care to avoid
s in the side of the neck) suffi-
man's hand. I then made my
the wound and take hold of the
ome force out of the wound, so
le. I then cut off the polypus,
ing however a seton in it, and
emainder of the day she refused

Dublin Society, vol. iii.

both food and drink: the next morning I had her turned for a few hours to grass, which she began to eat; and from the inclination of her head and neck whilst eating, a most considerable discharge of suppurated matter came from her nostrils. She, however, daily recovered: the suppuration from her nostrils soon disappeared; but the discharge from the wound in the neck continued in a considerable degree, by reason of the seton I had put into it, and which I further encouraged by the application of warm stupings twice a day. The animal, in the course of one week from the time of the operation, recovered perfectly, and is now as well as ever she was. I am, dear sir,

Your most obedient servant,
JOHN POLLOCK.

Rev. Dr. Lyster, &c. &c.

LVIII. *Description of Mr.* DAVID CHARLES's *Machine for laying Land level. By Lieutenant-Colonel* HARDY*.

SIR,

EVERY new invention that lessens the expense of manual labour must become an object to your society; I therefore beg leave to inclose the plan of an instrument for levelling ground, used by me this last season. Its application is simple, and its success so evident, that two neighbouring farmers borrowed it, and used it in the same manner.

Should the society consider it worth adopting, and that the sketch accompanying this letter is not sufficiently clear, I shall with great pleasure send a model to their repository.

I have the honour to be
Your most obedient servant,
JOSEPH HARDY.

Westmead Langhorne, Carmarthenshire, Jan. 5, 1803.

Mr. Charles Taylor.

This simple machine, which is the invention of my steward, and of which I have seen nothing similar, appears to me necessary, even in the most fertile parts of England, where the new system of drill husbandry has been introduced, or even where there is any attention to the

---

* From *Transactions of the Society of Arts*, &c. vol. xxi. The silver medal of the society was voted to Mr. Charles for this invention; and the thanks of the society were given to lieutenant-colonel Hardy for his communication, and for a model of the machine.

he ease of cattle in the act of
id of crooked or unequal ridges
low by cross ploughing, or else
ploughing in the winter and
y of our climate will not allow

of land last spring to a perfect
the ridges were above two feet
d where they were crooked and
cres of this is now under tur-
fficient time to ameliorate the
perhaps never before been ex-
sun and air; and by the adop-
d mode of sowing that root on
mmaterial where the upper stra-
egetates, as it soon strikes into
urishes.
ver, has been upon a field of
he unprofitable state already de-
is a deep clay, and which had
rom an old lay sod the former
vas winter ploughed, and lay in
r was introduced the first dry
receded by two horse ploughs,
n acre at once: these loosened
on furrow, and twice the breadth
veller followed, drawn by two
a man at each handle, to press
s to be removed, and to lift up
ere it is to be discharged. Thus
eight head of cattle, will more
acre to three roods in one day,
t or heavy, than sixty or eighty
th barrows and shovels, &c.,
f a plough. In sandy ground,
ow will bring all to a level, as
ne in one day as two ploughs
required to be gone over several
levelled, the backs of the ridges,
ere stripped of their vegetable
the furrows not requiring it.
nd the field copiously manured
ed in, and broke into nine-feet
n order to introduce Duckit's
ow, broad-cast, the last of it not
was cut down a reasonable crop
the

the 4th of September. I am now thrashing it, and a sample shall be sent, as well as a return of the eight acres, if necessary.

The field now lies in proper form, well manured, with the advantage of a fair crop from heavy tenacious ground, without losing a season, and in a year by no means favourable.

I am well aware there are many shallow soils where it may be hazardous to remove the enriched surface, and trust perhaps one-half of your land for a crop that had never before been exposed to the atmosphere; but where the soil is sufficiently deep, or you have good under strata, and there is manure at hand to correct what is sour from want of exposure and tillage, it is evident from this experiment that no risk is run.

To avoid the expense of a fallow, and to lay out ground in straight and even ridges, even where drill husbandry is not practised, should be objects to every rational farmer. But where the new system is intended to be adopted, it becomes indispensably necessary. In laying down lawns, parks, &c., where furrows are an eyesore, or places inaccessible to wheel carriages from their declivity, and from which earth is to be removed, it will be found equally useful.

Should the society consider the inventor, David Charles, worthy of any remuneration, honorary or otherwise, it will be gratefully acknowledged by

Your obedient servant,
JOSEPH HARDY.

Westmead,
Jan. 1, 1803.

Mr. Charles Taylor.

Description of the Machine.

Fig. 1. (Plate IX.) A, part of the pole to which the oxen or horses which draw the machine are fastened, and which is attached to the machine by a pin at B.

CC, The two wheels, shod with iron, which run upon the axle D.

EE, The upper frame-work of the machine, extending from the axle to the extremity of the handles FF, and secured firmly by the cross pieces.

GG, The curved iron sliders of the machine, which may be raised or depressed a little by means of the pins HH, which pass through holes in the wood-work, and also in the iron sliders; these sliders form one piece with the back iron scraper I, in the manner more fully explained in fig. 2.

K, The wooden back of the machine, which should be made

weight of the earth when col-
scraper should be firmly secured
work.
of the machine firmly connected
ork, in order to assist in col-
oved.
into which the ribs which sup-
ised.
art of the back of the machine.
arp at the bottom, and firmly
machine.
ons or sliders, showing the mode
ith the scraper I.
e described.

---

ublic Dispensaries in general;
rt of the Cases in the Finsbury
r the last three Months of the
ted by JOHN TAUNTON, *Esq.*
d Finsbury Dispensaries, and
urgery, &c.

r. Tilloch.

ution more beneficial or impor-
or its object the alleviation or
tutions are the strong-holds of
re they seek relief from all their
angements of dispensaries that
liarly considered.
oor of every denomination have
efits are extended to every spe-

t or trivial? In the dispensary
ne, while their families are not
their industry. Are they laid
fined by local disease or acci-
hey visited: the dispensary ex-
habitations. What plan more
sely ordered! It is adapted to
alady: it enters into the bosom
the diseased to health, while
fectionate offices of the health-
influence of the healing art to
ect.

But these are not the only advantages attending such institutions; they also present a wide field for observation and experience to the practitioner. Many cases of rare occurrence come under his care, and he is enabled to collect many useful and important facts.

Thus, while dispensaries extend their salutary influence to the diseased poor, they are subservient to the improvement of the healing art.

Every communication respecting these institutions must be interesting. The manner in which they are supported; the mode in which they are conducted; the aggregate in which they remove or diminish human misery; in which they cure or alleviate disease, and restore the objects of their care to their families, their friends, to the community, are all topics deeply interesting; and not less so are the histories of instructive cases, and the detail of important facts. It is proper that those who contribute to the support of these institutions should know the benefits derived from their philanthropy and munificence: it is proper that others should know them, that they may be induced to follow their example. It is also proper that the history of every instructive case should be faithfully told. The addition of one *real fact* to the general stock of medical or surgical knowledge is a gem of inestimable value.

From these considerations I have resolved to publish the surgical reports of the City and Finsbury Dispensaries, in conducting which I shall observe the following plan:

1st, I shall state the number of patients admitted under my care, in a given time, at each of these institutions.

2dly, I shall state the general events under the heads of cured, relieved, &c. And,

3dly, I shall make a few general observations on some of the more important cases, avoiding, as much as possible, technical terms, or those of art, which could be understood only by persons connected with medical science.

Surgical Patients admitted into the Finsbury Dispensary, St. John's Square, from the 1st of October to the 31*st of December,* 196.

Cured - - -	111
Relieved - - -	2
Irregular - - -	1
Dead - - -	2
Under cure December 31st -	80
	196

Thirty-

ome patients, and there have been
for an abscess in the tonsal gland;
the infra maxilla (or lower jaw),
igh, one for paracentesis (or tap-
for a tumour on the forehead,
ture).

eet, Clerkenwell, had been sub-
several years, which only came
nall, and never remained so long
ll the present attack; "though
by herself, were violent pain in
art itself, nausea and vomiting,
ng the debilitating effects of the

10th, during a violent fit of
ne down, and could not be re-
very painful, from which she
ight, as well as from the hiccup
ness which succeeded. On the
r was called in, whose attempts
unsuccessful. He therefore or-
ne cathartic medicines combined
were immediately returned with-
and every thing was rejected by
rnoon the symptoms had all in-
l over the fore part of the ab-
ald not bear the least pressure.
given, which produced syncope
ange to the hernia. The opera-
o which she would by no means

ed a letter for the Finsbury Dis-
t to me about four o'clock in the
I made several fruitless attempts
h was small but extremely pain-
circumstance, therefore, I con-
as the best mode of practice that
is opinion I was joined by Dr.
ysicians to the dispensary. But
t: and some pills were then or-
ned a principal ingredient. These
the stomach; and the fæculent
mited became so distressing, to-
she consented to have the opera-
s done at ten o'clock at night.

ernia was situated was unusually
thin,

thin, and did not contain any fluid; so that the greatest care was necessary to avoid wounding the intestine, which was of a very dark colour. The pulse, which varied during the day prior to the operation from 120 to 130, small and thready, was immediately reduced to 86, and was soft and regular. She took some gentle laxative medicines.

Nov. 13th. Has been very easy during the night, but has not had any discharge from the bowels. I ordered an enema, and a gentle dose of Epsom salts; which produced the desired effect: but she complained in the afternoon of being low, and thirsty. Pulse 106.

Nov. 14th. Has had a good night; fever less; pulse 96; but an extremely troublesome cough, for which some expectorant medicines were prescribed.

Nov. 15th and 16th. Continues to recover.

Nov. 17th. Dressed the wound, which had not completely adhered.

Nov. 19th. Recovering fast; appetite good; walks about the chamber, from which she does not experience any inconvenience. From this time the medicines were continued according to circumstances. She was now allowed animal food; the wound healed gradually; and she returned thanks, being perfectly cured, at the beginning of December.

I have been induced to give the above particulars on account of the very quick recovery of the patient from one of the most formidable and frequently fatal operations of surgery; which I attribute principally to the time of operating, the delay of which I have no doubt has proved fatal to many, as the performance of an operation when the vital functions are nearly exhausted can do little more than hurry on the fatal event.

Surgical Patients admitted into the City Dispensary, from the 1st of October to the 31st of December last, 204.

Cured - - -	84
Relieved - - -	3
Dead - - -	2
Under cure December 31 -	115
	204

Sixty-one of these patients have been visited at home, and ten have undergone operations; two of which, for fistula in ano, of several years standing, have been cured: one for an imperforated anus, which was unsuccessful from the malformation which appeared in the internal canal on examining

h, where the colon terminated in
s wanting : two cases of cataract
ouching: one case of an extra
ld only a few days old, which
n : one case of a tumour that had
lip for four years ; it was dissected
which united readily, leaving no
peration or disease ; the tumour,
ze, had become extremely un-
s in the hand, where the flexor
ne of which was necessarily re-
e scirrhous tumour in the breast,
for several years, completely dis-
of the emp. hydrarg. cum am-
eous and camphorated liniments.
, aged 45, observed a tumour in
n years ago, from which she ex-
e, except occasional darting pain,
ent, or continue long : it excited
ut May last, when from its size
ch uneasiness, and several pro-
onsulted. At this time the pain,
f the tumour appear to have been
characterized the disease : how-
en, considering it a common ab-
nto the tumour ; but, as will be
harge of matter followed. From
lly, the discharge was thin and
at, and the constitution suffered
ppeared to be going with hasty
m whence no traveller returns."
he was admitted a patient in the
ulcerated surface was nearly of
hes in diameter. She inquired
erformed ; which she was willing
ard, rather than endure her pre-
t of the disease rendered the re-
bsolutely necessary ; which was
er, with little interruption : two
secured till the operation was
the operation gradually left her,
fortable night ; and has not from
er fever or inconvenience in any
been expected from an operation
No medicines were given, ex-
keep the bowels regular, as she
was

was of a costive habit. The wound has been dressed about every fourth day, and is now nearly healed; her general health is good; and she has been enabled to attend the domestic concerns of her family, without inconvenience, for the last three weeks.

The manner in which this case terminates will be noticed in a subsequent report, as the success of an operation at so late a period in this disease must always be doubtful, and highly interesting.

A cast has been taken of the disease, which is preserved in my anatomical museum.

On this occasion I am extremely happy in having the opportunity of acknowledging the humane attention of Mrs. F****, who, on my representation, kindly visited and administered every necessary comfort to the poor family while the parent was under confinement.

The following Report is extracted from the Minutes of the Committee for managing the Affairs of the City Dispensary, of January 1806.

Surgical Patients admitted into this Institution from the 1st of January to the 31st of December 1805, 917.

Cured - - -	674
Relieved - - -	73
Dead - - -	17
Irregular - - -	7
Not known - - -	2
Under cure December 31 -	144
	917

364 have been visited at home, and 73 have undergone operations.

JOHN TAUNTON.

Greville-street, Hatton-garden,
January 15, 1806.

LX. *Description of M.* BARUEL'S *new Apparatus for making Gaseous Oxide of Carbon. By M.* DRYEUX[*].

IT is admitted on all hands, that for the progress that has been made in chemistry within the last thirty years, we are much indebted to the improvements that have been introduced into the apparatus employed. For example, before the apparatus which Woulf invented for obtaining the aëriform fluids disengaged from various bodies when exposed to the action of fire, or presented to other agents susceptible

---

[*] From the *Annales de Chimie*, No. 157.

hemists were obliged to employ
be managed, and so inconvenient
le to collect those fluids with cer-
f which were suffered to escape
d necessary in practice to prevent

paratus of Woulf, we experience
ences: the operations carried on
of the gas can be made in ves-
ty; we can divide the gases, and
nd quality very precisely: in fine,
s formerly very dangerous to the
ntinued for hours without risk or

any others have been added; and
they are owing to that perfection
rought the apparatus of Woulf;
ppy application which has been
in a number of circumstances.
s of this kind have been carried
t a great number more are yet in
is due to those who make exer-
ject, since the apparatuses which
new means put into the hands of
finity of products, which often
e knowledge might have an im-
cting of chemical science.
ve thought it would be useful to
vented by M. Baruel, lecturer in
Paris. This young chemist, per-
risks that are run in certain pro-
liberated, or when it is necessary
nation to different substances, has
he difficulties, and, after several
n apparatus the utility of which
s.
tus employed with great success
eous oxide of carbon. This gas,
be obtained with difficulty, and
ay now be procured with great
nse.
y also be used for the preparation
as, carbonized and phosphorized
e employed with equal advantage
ith any gas, especially when the
le at a high temperature.

I shall here give the description of the apparatus as communicated by the author, and exhibit a view and plan of it, which will make its parts more intelligible. (See Plate X.)

If gaseous oxide of carbon is wished to be obtained, let there be first introduced into three gun barrels, B, C, and D, charcoal, very dry and well chosen, broken into small pieces. By means of a thin piece of iron bring the bits of charcoal, but without compressing them, to that part of the gun barrels which is to be exposed to the action of the fire. Place the barrels horizontally in the furnace A, one by the side of the other, leaving between each a distance of about two inches; secure them in their places with clay, and then put on the dome of the furnace. This being done, into one end of the barrel B insert the glass tube E, which is so curved as to allow its other end to be introduced into the neck of the bottle F, which must be large enough to admit also the pipe of the curved funnel G. In the other end of the barrel B is inserted one extremity of the bent tube H; the other end of which tube is fixed into the barrel D, making a communication between D and B. In the same manner, the barrel D is joined to the barrel C by another glass tube I; and lastly, the other end of C receives the tube K, properly bent to pass under the receiver M, placed on the shelf of the pneumatic trough L.

Things being thus disposed, put carbonate of lime mixed with water into the bottle F; lute with care all the joinings of the tubes, and put fire into the furnace. When the gun barrels have acquired a red heat, pour sulphuric acid into the funnel G, which, when it passes into the bottle F, will liberate a quantity of carbonic acid gas from the carbonate of lime. The gas is obliged to pass through the tube E and the barrel B, and by the tube H is conveyed to the barrel D, and thence by the tube I into the barrel C, and through the tube K into the receiver M. The intention of the process is to make the carbonic acid gas pass through among the pieces of ignited charcoal contained in the gun barrels, and thus to saturate itself with as much carbon as it can take up.

It is easy to conceive that this is a more sure and expeditious method than that before employed, in which the gas was made to pass only through a single barrel. It is true the gas was submitted a second, and even a third time, to the same operation; but this was always attended with a waste of time and a loss of gas, which does not take place when this apparatus is employed.

LXI. *Ad-*

ments and Remarks on an artificial
ses the principal characteristic Pro-
By CHARLES HATCHETT, *Esq.*

§ I.

ied that carbonaceous substances,
ial, or mineral, were capable of
product, which, by its effects on
ions, on dissolved gelatine, and on
ural vegetable principle called *tan-*
ed to give it the name of *artificial*
t some eminent chemists of this
ions I have the highest respect,
objectionable; for, although the
bles tannin in the particulars above
ter there appears to be a very con-
ely, the effect of nitric acid; for
stance is produced, whilst the va-
re destroyed. Such an objection,
rity, induced me to alter the title
inge the word *tannin* wherever it
rtificial product.
yself more fully on this point, I
cation of my former paper, made
e comparative effects produced by
ances which contain the most no-
; and of these I shall now give a
all also cursorily notice other ex-
ning substance has been produced,
rent, in some measure, from those
described.

§ II.

et assert that the artificial tanning
destructible when repeatedly di-
ons of nitric acid, yet the follow-
ve that the destructibility of it by
t be a work of considerable time

is substance were dissolved in half
acid, the specific gravity of which
was then subjected to distillation

---

ns of the Royal Society for 1805.

until the whole of the acid had come over; after which it was poured back upon the residuum, and the distillation was thus repeated three times.

Care was taken not to over-heat the residuum, and this, when examined, did not appear to have suffered alteration in any of its properties.

2. Ten grains of the artificial tanning substance, mixed with ten grains of white sugar, were dissolved in half an ounce of nitric acid, and the whole was distilled to dryness.

The residuum, being then dissolved in boiling distilled water, and examined by solution of gelatine and other reagents, was found to be unchanged in every respect.

3. This resembled the former, only that gum arabic was employed in the place of sugar. The result was the same.

4. A quantity of dissolved isinglass was precipitated by a solution of the artificial tanning substance, and the precipitate, having been well washed with hot distilled water, was afterwards gradually dried. It was then digested in strong nitric acid, which after some time acted powerfully upon it; much nitrous gas was evolved, and a dark brown solution was formed. This was evaporated to dryness, and, after having been completely dissolved in boiling distilled water, was examined by nitrate of lime, acetite of lead, muriate of tin, and solution of isinglass, all of which formed copious precipitates, similar in every respect to those produced by the artificial tanning substance, which had not been subjected to the above described process.

5. A portion of the precipitate, formed by isinglass and the tanning substance, was dissolved in pure muriatic acid, and was afterwards evaporated to dryness. Boiling distilled water dissolved only a small part, and the solution, which was of a dark beer colour, did not precipitate gelatine, although it acted upon muriate of tin and sulphate of iron; for with the former it produced an ash-coloured precipitate, and with the latter a slight deposit of a reddish brown colour.

6. As so small a part of the precipitated isinglass had been thus rendered soluble in boiling water, the residuum was treated with nitric acid, as in Experiment 4; after which, being evaporated to dryness, it was found to be completely soluble in water, and precipitated gelatine as copiously as at first.

7. I dissolved twenty grains of the pure tanning substance in about half an ounce of muriatic acid; but, after distillation

e residuum in every respect ap-

: experiments may be added, that
cial tanning substance seem to be
, neither do they ever become
s of galls, sumach, catechu, &c.
d the very unchangeable nature of
ie following comparative experi-
Pegu cutch, kascutti, common

owdered galls were dissolved in
ng nitric acid; the solution was
s, and the residuum dissolved in
not produce the smallest effect on

f galls, evaporated to dryness, and
ly deprived of the tanning property.
ted by the infusion of galls was
nd examined as in Experiment 4;
ıld be discovered.
sumach were dissolved in half an
: acid, and treated as in Experi-
ıppeared that the tannin was de-

'egu cutch (which contains a con-
cilage) were subjected to a similar
ıxalic acid was obtained, but every
terated.
he catechu called *kascutti* afforded
'e.
the common cutch or catechu,
acid, evaporated to dryness, dis-
amined by solution of isinglass,
d: a tenacious film was deposited,
boiling water, and was evidently
tannin.
prepared oak bark, by the like
ution in water, which still acted
latine, as it caused a solution of
tly turbid; and a film, completely
er, was, as in Experiment 14, de-
ottom of the vessel.
epared, as nearly as possible of
, sumach, shavings of oak wood,
icial tanning substance: half an
each was then put into separate
glasses,

glasses, and one drachm, in measure, of the strong nitric acid was added.

The different infusions were then examined by solution of isinglass, and I found that those of galls, sumach, and oak wood, were not rendered turbid, whilst the contrary happened to the infusions of oak bark, and of the artificial substance; for these continued to precipitate gelatine, until four drachms, or half an ounce, of the nitric acid had been added to each half ounce of the infusion.

When the results of these experiments are compared, they seem to establish, that although the artificial product is by much the most indestructible of all the tanning substances, yet there is some difference in this respect even between the varieties of natural tannin; and that common catechu, and the tannin of oak bark, resist the effects of nitric acid much longer than galls, sumach, kascutti, and Pegu cutch. The last, as I have observed, is replete with mucilage, and by nitric acid yields a large quantity of oxalic acid; it also appears to be the most destructible of all the varieties of catechu; and on this account I attempted, although without success, to promote the destruction of the properties of the artificial substance by adding gum arabic in one case, and sugar in another, to different portions, previous to exposing it to the action of nitric acid. I am, however, convinced that the presence of gum or mucilage in natural substances which contain tannin, renders this more speedily destructible by nitric acid; and I shall soon have occasion to notice some experiments which tend to prove that the presence of gum or mucilage in certain bodies, also prevents, or impedes more or less, the formation of the artificial tanning substance. The cause of this difference, I am inclined to suspect, is, that in those bodies the gum or mucilage is not simply mixed, but is present in a state of chemical combination, by which certain modifications produced by the action of nitric acid upon the elementary principles of the original substance become facilitated.

§ III.

A. When sulphuric acid was added to a solution of the artificial tanning substance, the latter became turbid, and a copious brown precipitate subsided, which was soluble in boiling distilled water, and then was capable of precipitating gelatine.

B. The same effect was produced by muriatic acid; so that in these particulars the artificial tanning substance was the tannin of galls and of other

when added to a solution of the
deepens the colour; after which
and deposits a brown magma.
ry substance were dissolved in
nonia; the whole was then eva-
ng dissolved in water, was found
nless a small portion of muriatic

the same substance, which had
was evaporated in a long-necked
ry hot sand during half an hour;
e, and afterwards a yellow liquor
rned horn. The residuum was
found to be nearly insoluble in
communicated a slight yellow

the dry artificial tanning sub-
from vegetable matter, should,
, emit an odour very analogous
s, such as horn, feathers, &c.;
ase in the experiment which has
rous, therefore, to ascertain more
eat on this substance when di-

getable charcoal which had been
retort for more than an hour,
ed it into the artificial tanning

rendered as dry as possible, were
rt, to which a proper apparatus,
with quicksilver, and inverted in
apted. The retort was placed in
radually heated by a charcoal fire
hot.
ne warm, and after the expulsion
very small portion of water arose,
n the sides of the vessels: this
itric acid, from which the tan-
been completely freed; and soon
me over, which was in so very
stain the upper part of the neck

---

ent Parts of Astringent Vegetables. Phil.

of the retort: as nothing more seemed to be produced, I then raised the fire, when suddenly the vessels were filled with a white cloud, and so great a portion of gas was almost explosively produced, as to overset the jar: this gas, by its odour, appeared to be ammonia, which in the first instance had formed the white cloud, by combining with the vapour of the nitric acid, with which the vessels were previously filled *. Another jar was speedily placed in the room of that which had been overturned, and a quantity of gas was slowly collected: this proved to be carbonic acid, excepting a very small part, which was not taken up by solution of caustic potash, and which, as far as the smallness of the quantity would permit to be determined, appeared to be nitrogen gas. There remained in the retort a very bulky coal, which weighed eight grains and a half: this, by incineration, yielded one grain and a half of brownish white ashes, which consisted principally of lime; but whether any alkali was also present I cannot positively assert, as the trace which I thought I discovered of it was very slight.

I shall for the present postpone any remarks upon this experiment, as I wish to proceed in the account of others which have been made on the artificial tanning substance.

G. Fifty grains of this substance were dissolved in four ounces of water, and were afterwards precipitated by dissolved isinglass, eighty-one grains of which became thus combined with forty-six grains of the tanning substance.

The remaining portion of the latter was not precipitated, and was therefore separated by a filter, and evaporated to dryness. It then appeared in the state of a light brittle substance of a pale cinnamon brown colour; and it is very singular, that although charcoal is an inodorous body, and although the artificial tanning substance, when properly prepared, is likewise devoid of smell, (unless a certain pungent sensation which may be perceived upon first opening a bottle containing the powder after agitation should be so termed, but which seems rather to be a mechanical effect,) yet this substance possessed a strong odour not very unlike prepared oak bark; and this odour became much more perceptible when the substance was put into water; in which it immediately dissolved. The solution was extremely bitter, and acted but slightly on dissolved isinglass, with which, however, it formed some flocculi; with sulphate of iron it produced a brown precipitate; with muriate of tin,

---

* After the experiment the receiver was found to be thinly coated with a white saline crust.

brown; nitrate of lime had not
lead occasioned a very copious
ı colour. This substance, there-
ion of the tanning matter so mo-
:he characters of extract *.
: made on the tanning substance
ies, which by the dry and by the
ɔusly reduced to the state of coal:
ıt, and shall pass to the descrip-
ents, by which I obtained a va-
ing substance in a way different
n related, and with which I was
rmer paper was written.

be continued.]

---

emoir by Messrs. FOURCROY *and*
hænomena and the Products which
when treated with Nitric Acid.
ıstitute †.

in animal substances, by the la-
ıd the disengagement of this prin-
n of the nitric acid to these sub-
ıt beautiful improvements in mo-

/auquelin, by repeating these ex-
sh, have added to this valuable
:sting nature.

ve a concise account of their ex-
ılts which they have yielded.
:ammes of muscular flesh, with
acid of 32 degrees strength, and
:d into a matrass and heated to
ıt 96 inches of gas, which was
-tenths azote and one-tenth car-

of the remains of the flesh, still
ıs appearance; of a yellow liquor;
ıtty matter on the surface of the
l this matter and filtered the li-

' carbonate of ammonia it produced some
etable odour did not suffer any diminu-

quid, they submitted the fibrous residue to the following trials:

Boiling water was rendered yellow by it, and acquired at the same time the property of converting vegetable blues to a red; even the last portions of water assumed a yellow colour, although they no longer showed the presence of any acid. The residuum, after washing, acquired a still deeper colour, and when mixed with a little water reddened again the paper of turnsole.

When dissolved in alkalies it had a deep blood red colour: acids, on the other hand, precipitated it in the form of yellow flakes.

This matter is greasy and pitchy to the touch; it smells like rancid fat, and has a very acrid taste.

The fusion and swelling which it undergoes when placed over burning coals, the fumes of grease and the fœtid odour which it emits during this process, and the small portion of charcoal which it leaves, render it akin to fatty matters, although in fact it appears to be acid.

II. A more minute examination of this yellow substance has shown it to possess the following properties:

It neutralizes the alkalies so as to alter their qualities almost entirely: its combinations with potash and ammonia froth like a solution of soap: they are not decomposed by the carbonic acid; and they precipitate the solutions of mercury and lead in yellowish white flakes.

The yellow substance decomposes the alkaline carbonates with effervescence even in the cold, and the solution of acetate of potash with the assistance of a gentle heat.

On the application of alcohol, to which the celebrated authors of the memoir had next recourse, the substance in question is found to consist of a small quantity of greasy matter which the alcohol takes up, and of an acid, to which on account of its colour they have given the name of the *yellow acid.* When deprived of the grease which alters its properties, the yellow acid assumes a deeper colour: it reddens in a greater degree turnsole paper; it no longer melts in the same manner, and exhales not the odour of burnt grease, but fœtid and ammoniacal vapours.

The yellow acid dissolves in grease, and renders it at the same time acrid and rancid. It combines with ammonia, which it deprives of its odour; it yields, by distillation, all the products of animal substances; therefore consists of azote, hydrogen, carbon, and oxygen; and ought to be ranked among the animal acids.

III. The yellow matter, composed of the yellow acid and

d anew to the action of nitric
f about 50°, underwent no very
:llow colour was converted to a
, and volume were diminished,
effervescence in the acid; it red-
it dissolved, as before, in a so-
it communicated an orange red
extremely acrid. The action of
low substance extends no further
the state of an oil, and does not
s which were originally commu-

:h had been employed in the de-
ar flesh was next examined. Its
uch the colour of a solution of
ng the supersaturation of the li-
tash it first assumed an orange
dy, and let fall a small quantity
. When this mixture was sub-
: over a clear liquor, without co-
nell, and containing a small por-
ly formed by the action of the
ned in the retort had assumed a
was neglected to be examined.
c acid which had been employed
on distillation a colourless liquor,
odour. The liquid remaining in
:r yellow when concentrated, and
acid became speedily apparent by
t of red vapours; when reduced
llized in flattened needles, in the
which was thick and tenacious

f an acid and bitter taste, assumed
ddition of a small quantity of pure
vith alcohol let fall a white floccu-
into fine semi-transparent grains,
taste. Five decigrammes of this
venty-one centigrammes of a yel-
vas very light, and dissolved with
l: the solution yielded on evapo-
e of lime and nitrate of potash.
rown down by alcohol, was found
f sulphate of lime and acidulous

dy treated with alcohol yielded,
on

on the addition of lime water, a second precipitate, which was found to be no other than the oxalate of lime. By gently evaporating the fluid which remained after these two precipitations the liquor thickened into a viscid brown syrup, having a bitter taste somewhat similar to that of walnut rind: when mixed with a large quantity of alcohol a very abundant separation of a white matter took place, and the whole was formed into a coagulum. This matter consisted of very pure malate of lime, and the alcohol containing in solution the yellow bitter substance.

The learned authors of the memoir from which we give a detailed extract, infer from the facts above stated, 1. That muscles contain potash, lime, and sulphuric acid, or rather sulphur which has been oxygenated by the action of the nitric acid: 2. That a portion of the muscular fibre, or rather of the cellular substance in which it is enveloped, becomes converted by the nitric acid into malic and oxalic acid.

The alcohol employed to effect the separation of the malate of lime held in solution, 1. a small quantity of nitrate of lime; 2. a reddish brown matter, having a very bitter taste, with a flavour like that of walnut, of which we shall speak hereafter; 3. a small portion of the detonating substance which has been found in indigo: it was obtained in this instance by the concentration of the alcoholic solution, and separated in the form of granulated crystals, which were highly inflammable, and detonating, upon the addition of carbonate of potash.

V. A little consideration of this analysis will readily convince us of the importance of the inferences which it affords, more especially when we compare the information hitherto possessed upon this subject with the more extended ideas which it opens upon a point so interesting in its consequences and in its application to the animal œconomy: indeed we may almost venture to assert, that there is now little left to be desired upon the subject.

The disengagement of azote, and the formation of carbonic acid, of fat, of oxalic acid, and of a bitter matter, were all the facts formerly known regarding the action of nitric acid upon animal substances: to these our authors have added the discovery, 1. of a yellow and almost insipid matter, which, although acid, dissolves with difficulty, and which immediately replaces the fleshy fibre; 2. of another yellow substance, bitter to the taste, more soluble, and equally acid, which remains dissolved in the nitric liquor; 3. of an inflammable detonating substance which lution; 4. of the formation of the

: opinion of Messrs. Fourcroy and
w and little soluble matter is the
ich the muscular fibre undergoes;
o a second stage of alteration and
soluble matter is produced: this,
aced by the inflammable and deto-
g the third and last step in the
ie nitric acid. They attribute the
hese three compounds to the sub-
ie azote, and of a larger quantity
iuscular flesh: in this way the re-
r elements are altered, and there
ion and oxygen, which communi-
fat and acidity which we remark.
rinciples constituting these three
of such difficulty that we cannot
olved.
at the acidity of the yellow sub-
gree upon the presence of nitric
n every attempt to detect it.
acids, they conceive, are formed
ous layers of cellular substance;
med by comparative experiments
ranous parts of the body, which
the application of the nitric acid,
lic and oxalic, but very little fat

cts, which have hitherto appeared
oplication, seem naturally to con-
e presented by the analysis before
ists to whom we owe it have very
connection. Such are the facts
: examination of the biliary con-
, more especially those found in
: such also are the resemblances
nnection between the bile and the
ne in cases of *icterus* (jaundice),
which are mentioned in this me-

stituted with a view to verify their
with the most favourable results.
concretions, when separated by
ter matter with which it is mixed,
ters which distinguished the first
yellow

yellow matter furnished by the action of nitric acid upon muscular flesh.

They obtained from the urine of a young man labouring under slight jaundice, a red substance, having an almost exact resemblance to the matter afforded by muscle and nitric acid. It was procured by treating with alcohol a quantity of urine which had been evaporated to the consistence of honey. The alcohol contained the red matter which they sought, besides a large quantity of urea, of sal-ammoniac and of acetate of soda, which the patient had been using internally.

These experiments, executed with that admirable talent and ingenuity which the celebrated authors of this memoir manifest in all their inquiries, would induce us to conceive, with them, that jaundice is produced by the superabundant quantity of this matter, and its consequent introduction into the system of the cutaneous absorbents: that it is this substance which communicates a yellow colour to the bile and to the biliary calculi, which afford, on analysis, evidence of its presence: that this yellow acid is formed in the animal œconomy either by the oxygenation of the muscular fibre, or of the fibrine of the blood.

Does there not appear to be a decided similarity between this yellow acid matter and the acid which is found in fat that has been long exposed to the air, as well as in that which has acquired a yellow colour from disease, and in the fat treated with nitric acid so as to form oxygenated ointments?

Are we not forced to acknowledge that these ideas acquire great additional probability from considering that the acetate of soda, the alkaline carbonates, the yolks of eggs, are at once the remedies which are most successful in the treatment of jaundice, and the best chemical solvents of the yellow acid, or of that fatty and acid matter which so evidently is present in *icterus?*

And lastly, Can we still remain in the opinion that the expectation of determining the proximate cause of diseases is founded on a mere chimera; and that the discoveries of chemistry, or successful researches into animal substances, will fail to throw the most important light upon the nature of diseases, and the mode of their cure?

e Means of rendering Smutty
Translated from the Biblio-
que by the Rev. JOHN DUBOUR-

bjects; the first, to increase the
the market; the second, to pre-
from it.
tty when the chests of some of
st instead of a farinaceous sub-
ks in the operation of threshing,
e sound grain spoils its colour,
of blackness to the flour.

of Smutty Wheat.

n proportion to the quantity of
llow:—The infected grain never
e granary, and consequently it
g; for the black dust with which
moisture from escaping in the
market, it is sold four francs
setier‡ cheaper than grain of the
diseased. When it is taken to
remained a considerable time in
mill-stones, greases the bolting-
g, and gives less flour. The
d after that which is smutty, is
ins of the latter. The flour of
y white, soft and greasy to the
rtionably absorbs but little water,
grease, and is difficult to keep.
ons the different modes that have
defect in grain, and which have
at of sifting it often; 2dly, dry-
the granary; 3dly, by mixing
ed to powder with it; 4thly, by
drying, and sifting it. He then
n completely as the only method
cts of this disease, which those
e anxious to bring only grain of
ave hit upon.

---

of the Dublin Society, vol. iii.
I have translated *sweats.*
equal to twelve bushels.

Mode

Mode of washing Smutty Grain.

Water from wells, springs, or streams, may be used with equal effect: to employ it, proper vessels must be procured, as buckets, shallow tubs, and casks open at one end; but in preference to these, a large flat cistern with a sluice, the inside of which should be covered with a piece of linen, or of tin perforated, to facilitate the escape of the water impregnated with the smutty matter, and to prevent the passage of the grain. This operation is more easily performed when near the water: in that case the wheat may be washed in baskets so close as to retain the grain. The mere motion of the water is insufficient to detach the dust from the wheat; it must be stirred with a broom, and rubbed with the hands, in small quantities at a time; the foul water must be let out of the cistern, and fresh water put upon the wheat, until it runs off clear. If it is washed at a river or a well, the basket must be plunged in it several times. It is, however, to be observed, that this operation must be performed as quickly as possible, that the grain may be washed without being softened, to prevent the difficulty in drying it, and to avoid wrinkling the skin.

Drying the washed Grain.

The moment the grain is taken out of the water, it ought to be spread on cloths in the open air; in the southern provinces, where it is customary to wash grain, it is dried in the sun. This method is preferable to any other, and at the same time the most œconomical; and in our climate (France) a cogent reason for washing smutty grain immediately after harvest, is to take advantage of the heat of the sun in the latter end of August, or the beginning of September: besides, the sooner the grain is washed, the more easy and effectual is the operation.

If the weather will not permit the grain to be dried in the open air, it must be spread very thin on the floor of the granary, and often turned to prevent its heating, and to allow a free escape to the adventitious moisture. If the weather happens to be moist and warm, and likely to make it sprout, it should be dried in an oven moderately heated. In whatsoever way the grain has been dried, care must be taken not to leave it in heaps, nor to press it closely together, until it is perfectly cool, and has been passed two or three times through the riddle.

f washing and drying Grain.

not difficult; they only require
ho performs them will not have
noments thus employed when he
it advantages. These advantages
ing his grain, or of using it im-
t with old grain, without any in-
to wheat its natural facility in
roduce in flour greater than when
has not that dirty whiteness, and
lant on smutty grain; it is more
bs more water in baking. Bread
all the qualities that can be wished
he grain is to be sold, it acquires
ourth above that which is smutty.
nat by washing wheat it loses the
nd from this circumstance suffers
On this it must be remarked, that
executed, particularly if the grain
be penetrated by the moisture;
d, and will preserve its size and
weight will be small when com-
above stated.
nich have required it, this prac-
n success both by great and small
eal in wheat, and by private per-
ir own flour. It is the constant
bakers, who otherwise could not
lity in those seasons when smutty
n such years has been the means
and intelligent persons who have

flections.

itioned in this memoir, the farmer
hing but washing and drying can
of smutty wheat. It is, then, his
eration, because, if he does it not,
l do it for him, and have all the
it obtain for himself. Even for
ought to practise it, as both him-
better bread, which costs less in
ght to employ this method, as
or the sake of humanity, because
is prepared cannot be unwhole-
some;

some; and thus the farmer will be free from all uneasiness on this subject, and from every well founded reproach.

Observation by the Translator.

The climate in France being so much warmer than ours, is the reason the author mentions ovens for the purpose of drying wheat: in close and moist weather, after washing, the sun and air being in general sufficient to prepare wheat for grinding, kilns are not in use as with us, where all grain, unless kept a considerable time on the straw, requires that process to make it *work*; nor will it keep in any considerable quantity unless kiln-dried, and even in that state it requires constant turning: therefore to millers, who always dry their wheat, and who of course are near to water, the operation of washing seems peculiarly adapted in seasons when the smut is common.

The author does not seem to be acquainted with lashing of wheat to free it from the straw: when this operation is performed, the smut balls are not broken as they are by the flail, and consequently less of the black powder adheres to the grain; and the balls, being lighter than the wheat, may be separated by repeated and careful winnowing. But the second quality, which is obtained by threshing, after lashing, and amongst which the smut balls are broken, ought certainly to be washed.

LXIV. *Specification of the Patent granted to* Arthur Woolf, *of Spa Fields, in the County of Middlesex, for certain Improvements in the Construction of Steam-Engines. Dated June* 7, 1804*.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Arthur Woolf do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows: that is to say, I have ascertained, by actual experiments, and have applied the same to practice, that as in practice it is found that steam acting

---

* In our nineteenth volume, p. 133, we gave some account of the subject of this patent; and in our present volume, p. 123, we laid before our readers Mr. Woolf's specification of a subsequent patent for improvements on steam-engines, which may be considered as a supplement to the former. A number of our readers having, however, requested that an entire copy of Mr. Woolf's specification of his first patent might appear in our work,—in compliance with their wishes we now insert it.

of four pounds the square inch,
xposed to the atmosphere, is ca-
f to four times the volume it then
equal to the pressure of the atmo-
r steam of the force of five pounds
nd itself to five times its volume.
eam of the like expansive force of
r ten pounds the square inch, can
n, eight, nine, or ten times its vo-
ively equal to the atmosphere, or
cient action against the piston of a
same to rise in the old engine (with
men, or to be carried into the va-
n the improved engines first brought
d Watt: and this ratio is progres-
irely, uniform; so that steam of the
, thirty, forty, or fifty pounds the
safety-valve, will expand itself to
ifty times its volume; and, gene-
ediate or higher degrees of elastic
nes which steam of any tempera-
d itself is nearly the same as the
able to sustain on a square inch,
atmospheric pressure; provided
place or vessel, in which it is
be at least of as high a tempera-
temperature, as that of the steam
to expand: that is, whatever be
ry to the permanency of steam of
nds the square inch, if steam of
he space, place, or vessel in which
o expand itself, should be of the
arly so; and so with steam of
hirty, forty, or fifty pounds the
lace, or vessel in which it is to
bout the same degree of heat as
oyed requires for its existence; in
ore stated, steam can expand itself
e number of pounds it could have
n as aforesaid, before it is allowed
f. Here, however, it may be ne-
stating this ratio I only speak of
t can be managed and commanded
e absolute expansion which per-
if mechanism could be made so
cape of steam, and all partial con-
densation

densation of it and waste of heat; for the real expansive force of steam, I am inclined to believe, from the experiments I have made, increases in a regular ratio a little beyond what I have stated, though I would not recommend that it should be calculated higher in applying it to steam-engines, because the difficulty of confining and managing it increases also as the elasticity of the steam is increased, or as its temperature is increased.

And here it may be of use to the public to state some facts respecting different degrees of temperature required to bring steam to, and maintain it at, different expansive forces above the weight of the atmosphere; because the temperature of the steam indicated by a thermometer, having its bulb in the boiler which produces it, will indicate the expansive force of the steam, without the trouble and inconvenience of changing the weights on the valve, by which its force is regulated for the work intended to be performed by it, and which valve acts as a common safety-valve, so that those who attend the boiler will know with sufficient precision, by looking at the thermometer, how they ought to feed the fire; and, moreover, the relation between the temperature and the expansive force being known, the danger of accidents from the safety-valve becoming deranged will be lessened, for the workman will naturally be led to notice whether the safety-valve acts freely when the thermometer has risen to the degree that answers to the weight with which the valve is loaded for working. I have found by actual experiment, setting out from the boiling point, or two hundred and twelve degrees of the thermometer, commonly employed in this country, which is that of Fahrenheit, at which degree steam of water is only equal to the pressure of the atmosphere, that, in order to give it an increased elastic force equal to five pounds the square inch, the temperature must be raised fifteen or sixteen degrees, or to about two hundred and twenty-seven and a half, when the steam will have acquired a power to expand itself to five times its volume, and still be equal to the atmosphere, and capable of being applied as such in the working of steam-engines according to my said invention. And with regard to various other pressures, temperatures, and expansive forces of steam, the same are shown in the following table:

res per square inch, temperatures
im at degrees of heat above the
eginning with the temperature of
e equal to five pounds per square
eam able to sustain forty pounds

Degrees of Heat.		Expansibility.	
227½	and at these respective degrees of heat, steam can expand itself to about	5	times its volume, and continue equal in elasticity to the pressure of the atmosphere.
230¼		6	
232¾		7	
235¼		8	
237½		9	
239½		10	
250½		15	
259½		20	
267		25	
273		30	
278		35	
282		40	

, by small additions of tempera-
nay be given to steam to enable
y, seventy, eighty, ninety, one
ree hundred, or more times its
ation but what is imposed by the
naterial of which boilers or other
e been or can be made; and pru-
ansive force should never be car-
rials can bear, but rather be kept
mit.

ned my discovery of the expan-
eam, I shall proceed to describe
ed thereon; and in so doing, I
nention the entire steam-engine,
an invention well known, I nei-
exclusive claim; but at the same
that, from the nature of my said
ion, there can be no difficulty in
provements from the improved
mon and well known component

nstructed originally with the in-
d improvements, it ought to have
ent dimensions, according to the
ive force determined to be com-
nade use of in working the en-
m-vessel, or cylinder, must be a
measure

measure for the larger. For example, if steam of forty pounds the square inch is fixed on, then the smaller steam-vessel should be at least one-fortieth part the contents of the larger one. Each steam-vessel should be furnished with a piston, and the smaller cylinder should have a communication both at its top and bottom (top and bottom being here employed merely as relative terms, for the cylinders may be worked in a horizontal, or any other required position, as well as vertical). The small cylinder, I say, should have a communication both at its top and bottom with the boiler which supplies the steam; which communications, by means of cocks or valves of any construction adapted to the use, are to be alternately opened and shut during the working of the engine. The top of the small cylinder should have a communication with the bottom of the larger cylinder, and the bottom of the smaller one with the top of the larger, with proper means to open and shut these alternately by cocks, valves, or any other well known contrivance. And both the top and bottom of the larger cylinder or steam-vessel should, while the engine is at work, communicate alternately with a condensing-vessel, into which a jet of water is admitted to hasten the condensation; or the condensing-vessel may be cooled by any other means calculated to produce that effect. Things being thus arranged, when the engine is at work, steam of high temperature is admitted from the boiler, to act by its elastic force on one side of the smaller piston, while the steam which had last moved it has a communication with the larger steam-vessel or cylinder where it follows the larger piston now moving towards that end of its cylinder which is open to the condensing-vessel. Let both pistons end their stroke at one time, and let us now suppose them both at the top of their respective cylinders, ready to descend; then the steam of forty pounds the square inch entering above the smaller piston will carry it downwards, while the steam below it, instead of being allowed to escape into the atmosphere, or applied to any other purpose, will pass into the larger cylinder above its piston, which will take its downward stroke at the same time that the piston of the smaller cylinder is doing the same thing; and while this goes on, the steam which last filled the larger cylinder in the upward stroke of the engine will be passed into the condenser, to be condensed during the downward stroke. When the pistons in the smaller and larger cylinder have thus been made to descend to the bottom of their respective cylinders, then the steam from the boiler is to be shut off from

to the bottom of the smaller
cation between the bottom of
he larger cylinder is also to be
tion to be opened between the
ottom of the larger cylinder;
wnward stroke of the engine
ng now open to the condenser,
tween the bottom of the larger
hut off; and so alternately ad-
rent sides of the smaller piston,
tted into the smaller cylinder
erent sides of the larger piston
top and bottom of which are
ately with the condenser. In
improvements which have been
m is admitted to one side of the
er, the steam on the other side
sion into the larger cylinder on
condensation going on on the
on which is open to the con-
team which takes place in en-
xpansive force of steam, from
prevented; for all steam that
ller cylinder is received into the
where it may be more conve-
rpose, the arrangement may be
smaller made to communicate
nd the bottom of the smaller
er cylinder; in which case the
when the piston in the smaller
e larger will ascend, and while
er will ascend; which for some
more convenient than the ar-

iving a proper degree of strength
ases for the same, which are to
strong steam, increases in pro-
mented; instead of employing,
or steam measure, one cylinder
eam-engines of great power, I
ng for the latter cylinder two or
ameter, but of such dimensions
area of the pistons worked in
of the one piston, and the ca-
which otherwise would be ne-
ted cylinders are made to com-
municate

municate with each other, that they may at one and the same time receive and part with the steam by which the engine is worked; and their respective piston rods are so connected with one another, or with other parts of the machinery, that the pistons may act together.

3dly, With regard to steam-engines which are already constructed, I improve the same by adding thereto a small cylinder or measure for the steam admitted to the working cylinder: this improvement may be introduced with great advantage into the steam-engines constructed according to Mr. Watt's improvements; which small cylinder may be either employed only as a measure of the steam, or a piston may be worked in it by the expansive force of the steam, before it be allowed to pass into the present working cylinder or steam-vessel, which in that case must have no direct communication with the boiler, but must be supplied with steam through the medium of the small added cylinder or steam measure. To make this more intelligible, suppose the steam measure or small cylinder added to one of Mr. Watt's single engines, or to one of similar construction, and that the small added cylinder is furnished with a piston to work by the expansive force of the steam, while the larger cylinder works by condensation; then all that is necessary is, that the top of the smaller added cylinder be connected with the boiler, and furnished with a cock or valve to shut off the steam, and that the boiler be of sufficient strength: let a pipe pass from the top to the bottom of the smaller added cylinder, furnished with a cock or valve, by which a communication may be made between the two sides of the piston in the said cylinder; let a pipe also pass from the bottom of the smaller cylinder to the top of the larger; let the larger cylinder, as is now commonly the case in practice, have a pipe passing from its top to its bottom, by which a communication can be made between the two sides of the piston in the large cylinder; and let the large cylinder communicate with a condensing-vessel, with valves, cocks, or any other contrivance to open or shut the different communications when necessary. Things being thus arranged, suppose the engine at work, and the pistons in both cylinders at the top of their respective cylinders, and suppose the steam admitted to enter the small cylinder above the piston: while the steam is thus entering, let the communication between the bottom of the small cylinder and the top of the large one be open, while the bottom of the large one is open to the condenser; then both pistons will descend. When they have reached the

bottom

e cylinders, the communications
the small cylinder, between the
linder, and between the latter and
e shut off; and the communica-
ween the two sides of the smaller
o sides of the larger piston: then,
steam which was last admitted
l pass to its under side, while the
itted to the top of the large from
cylinder will pass into the lower
nder its piston, and both pistons
nd by the action of the counter-
n of the fly, as the case may be.
reached the top of their respective
ed communications are shut, and
efore, and both will descend; the
tted to the under side of the small
er end of the large cylinder, while
below the piston of the large cy-
enser. Or an arrangement similar
lopted: Let only the bottom part
ave a communication with the
lso a communication between the
the top of the larger cylinder, and
etween the top part of both cy-
oned communication always re-
op and bottom of the large cy-
by means of a side pipe; and
large cylinder communicate with
g thus arranged, when steam is
part of the smaller cylinder, the
vill ascend; the communication
o cylinders being then open, to
e smaller piston to pass into the
is not to be detained, but, along
iston in the large cylinder, to be
last-mentioned piston (which is
the piston in the smaller cylin-
etween the two sides of the large
nd the communication with the
pistons having reached the top
ers, the communications which
ow be shut (excepting the com-
vo cylinders at their upper part),
etween the bottom of the small
and between the bottom of the
large

large and the condenser, must be opened: the steam last admitted into the lower part of the smaller cylinder will now ascend into the top of the larger and expand itself, following the piston of the larger cylinder which is now descending, its other side being open to the condenser; and (as the tops of the two cylinders communicate) steam will also pass into the top of the smaller cylinder above its piston, so that both pistons descend together to the bottom of their respective cylinders; when a fresh charge of steam is again to be admitted for a fresh stroke of the engine.

4thly. If my improvements be applied to one of the engines known by the name of Watt's double engine, the working cylinder must have no direct communication with the boiler, but must be made to communicate at its top and bottom alternately with the lower and upper part of the smaller added cylinder, or simply, as the case may be, at its top and bottom, with the steam measure, which has a direct communication with the boiler; the effect of which must be sufficiently obvious from the details I have already given respecting the nature of my invention, and the way in which the same is to be carried into actual practice.

5thly. With regard to steam-engines, in which the separate steam measure may not be thought advisable, the same may be improved by the application of my aforesaid discovery, by making the boiler, and the steam case or cases in which the working cylinder or cylinders is or are inclosed, much stronger than usual; and by altering the structure and dimensions of the cocks, valves, slides, or other means of admitting steam from the boiler into the cylinder or cylinders, in such a manner as that the steam may be admitted very gradually by a progressive enlargement of the aperture, so as at first to wiredraw, and afterwards admit more freely the same. The reason for this precaution is this: Steam of such great elastic force as I employ, if admitted suddenly into the cylinder or cylinders, when more than one working cylinder is employed, would strike with a force that would endanger the safety and durability of the engine. The aperture allowed to the valve, cock, or other contrivance for admitting steam into the cylinder or cylinders, should be regulated by the following consideration:—If the intention is that the engine should work only, or almost wholly, by condensation, the steam in passing into the cylinder or cylinders should be forced to wiredraw itself, as I have already said, but so that the piston or pistons may perform the whole or a great part of the stroke by the time the intended quantity of steam has been admitted into the

for example, when steam of forty
used, such a quantity of the same
ie to one-fortieth of the capacity
lers, and so in proportion when
is employed; and when the re-
admitted, the steam is to be shut
nt for admitting a fresh quantity.
t advantage shall also be taken of
m acting on one side of the piston
sation goes on on the other side,
dmitted more freely, but still with
ie reason already mentioned. And
y other application of my said im-
i my said discovery of the law of
lue and effectual means must be
site temperature of all the parts of
h the steam is admitted, and in
o be condensed. And here it may
instead of the obvious and usual
this, namely, inclosing them in
case or cases communicating with
method may sometimes be used
eparate fire under the steam case
event, will become a boiler or
ished with a safety-valve or valves
re. By means of the last-men-
steam from the smaller cylinder or
her of these is employed) may be
linder or cylinders kept at a higher
ller, by which its power to expand
and, on the contrary, by keeping
erature than the smaller, its ex-
d; which, on particular occasions,
ses, may be desirable. In every
hat the boiler, the case or cases
cylinders is or are inclosed, the
y all the parts exposed to the ac-
e of the steam, be of a strength
pressure to which they are to be
to the due degrees of strength of
improvements, together with the
and the proportions of the same,
ed, I forbear any further descrip-
numerous variations to which the
; and because every engineer, of
oyed in works of this nature, will,
without

without difficulty, arrange and determine the same according to the nature of the case.

Lastly. I have to observe, that, to avoid unnecessary tautologies in speaking of the proportion that ought to subsist between the smaller cylinder or the steam measure and the larger cylinder, or the quantity of steam to be admitted to the working cylinder, where a separate smaller cylinder or steam measure is not adopted, though I have mentioned the regular proportions, as, for example, of a measure or quantity equal to one-fortieth of the working cylinder when steam of forty pounds the square inch is to be employed, or equal to one-thirtieth, or one-twentieth, when steam of thirty or twenty pounds the square inch is to be used; yet these are not the only proportions that may be used; for, though it may not be advisable that the proportion of the smaller cylinder or steam measure should in any case be made much smaller than I have stated, yet, in making it larger, considerable latitude may be allowed: for example, with steam of forty pounds the square inch, a smaller cylinder or measure of one-twentieth, or even larger, or of some intermediate proportion, may be employed instead of one of a fortieth of the capacity of the larger or working cylinder; and so with steam of any other given strength. And it may be advisable, that in a number of engines this should be the case, because of the difficulty of preventing some waste of steam or partial condensation which might lessen the rate of working, if not allowed for in the size of the smaller cylinder or steam measure; or in the quantity of steam admitted directly from the boiler into the working cylinder, where no smaller cylinder or steam measure is employed: and in every case the engine, when got ready for work, whatever may be the proportion that has been adopted as intended to be worked with, should have its power tried, by altering the load on the valve that ascertains the force of the steam, in order that the strength of steam best adapted for the engine may be ascertained; for it may turn out to be advantageous that the steam should be employed, in particular engines of an elastic force, somewhat over or under what was first intended.

In witness whereof, &c.

Nature of Blighted Corn. Ex-
r read at the Institute 30*th Feu-*
iy Messrs. FOURCROY *and* VAU-

s already engaged the attention of
ntier found in it a fœtid greasy
harcoal; Cornette has discovered
Girod-Chautrans has announced,
nce of an acid both free and com-
d to be of a peculiar nature.

scovery was announced to the In-
ırds the end of the year 12, that
ied ourselves to examine with ac-
able matter.

1, is, in fact, a disease of the grain
husk of the seed, where the fa-
ht to be found, a black powder,
guished by the dangerous quality
y contact, and communicating to
g up blighted. The most effectual
contagion, and preventing the dis-
is, to wash the grain with lime
olution: without this precaution,
use among all well-informed hus-
uniformly reproduced.

which our experiments were made
Girod-Chautrans, whose zeal for
nce, and enlightened love of na-
own.

ortar of flint, and separated from
nunicated to hot alcohol a greenish
cid property; and there was sepa-
atter of the consistence of butter,
Ether, also, produced the sepa-

eing thus acted on by the alcohol,
eel, and its peculiar odour of sea-
ith five times its weight of boiling
l a reddish brown colour, a fœtid
oapy quality, and a decidedly acid
ined by different appropriate re-
ved to be the phosphoric.

---

séum d'Histoire Naturelle, No. 35.

By washing the pure blight with boiling distilled water, without treating it with alcohol, the liquor became sensibly acid, and when saturated with potash yielded a precipitate of an animal matter mixed with phosphate of ammonia and magnesia, at the same time exhibiting every mark of the presence of an alkaline phosphate. Thus have these experiments confirmed the opinion that phosphoric acid exists uncombined in blight; for we have a sufficient proof of this in its fixity, its insolubility in alcohol, its solubility in water, and its precipitation by lime water, &c.

The water held in solution, after the acid had been precipitated by potash, a fœtid animal matter, altogether similar in its colour, odour, and in the phænomena of its precipitation by different re-agents, to that which is found in water where the gluten of flour has been left to putrefy.

After the successive action of the alcohol and water, the blight of wheat still retained its fœtid odour and greasy feel. When distilled with a naked fire, it yielded one-third of its weight of water containing acidulous acetate of ammonia; nearly one-third of a dark brown concrete oil, very similar to adipocère in its form, consistence, and easy fusibility; also 0·23 of a charcoal, which left, by incineration, a white cinder weighing one-hundredth part of the original quantity of blight, and consisting of three-fourths phosphate of magnesia and one-fourth phosphate of lime.

We examined blight without removing the husk, and found that this had no influence in varying the ultimate result of the analysis.

We would conclude, from the examination which we have just detailed, that the blight of wheat contains,

1. A green oil, having the consistence of butter, fœtid and acrid, soluble in heated alcohol and ether, forming nearly a third of the weight of the blight, and communicating to it its greasy feel.

2. A vegeto-animal matter soluble in water, insoluble in alcohol, and precipitating the greater number of the metallic salts as well as nut-galls. It forms rather less than a fourth part of the blight, and resembles completely the substance which is produced by the putrefaction of gluten.

3. A charcoal, amounting to a fifth part, which gives a black colour to the whole mass, and is at once the proof and the effect of a putrefactive decomposition; as it is also in garden mould, and indeed in the remains of all putrefied organic compounds.

4. Phosphoric acid in a free state, forming only 0·004 of the

to give it the power of reddening

ıhates of ammonia, of magnesia,
roportion of some thousand parts.
eat is only a residuum of putrefied
the constituent elements of this
, saccharine matter, contains only
bstance very similar to that species
its origin from animal or vegeto-

mind, that properties very similar
wheat were presented to us during
n decomposed by putrefaction, and
one approach so near to those of
t difficult, in some cases, to avoid
leed, it requires considerable expe-
ions to discover the slight differ-
ese two putrefied matters; for they
ght shades which are caught with

he results of this analysis may ap-
t the knowledge which they afford
light serves to throw but little light
gious quality; which is now proved
, that there can no longer remain
nust also confess that these results,
consist of the residuum of putre-
etely accord with the ideas of those
sts who regard this disease as the
ion; for, agreeably to our analysis,
sonable to consider it as the effect
ition, which may arise from many
les the influence of infection*.
s also to think that the septic pro-
recedes the formation of blight in
ng from contagions or occurring
n particular the gluten, and antici-
formation of starch; for we well
f which no traces are discoverable
ation from the putrefaction which
ıbstance of gluten.

---

per which we have laid before our readers,
ht as a vegetable fungus. If this be admitted,
rganization of the grain being destroyed by
fungi, a slow decomposition of the seed must

LXVI. *Ex-*

LXVI. *Experimental Inquiry into the Proportion of the several Gases or Elastic Fluids constituting the Atmosphere.* *By* JOHN DALTON*.

IN a former paper which I submitted to this society, "on the constitution of mixed gases," I adopted such proportions of the simple elastic fluids to constitute the atmosphere as were then current, not intending to warrant the accuracy of them all, as stated in the said paper: my principal object in that essay was, to point out the *manner* in which mixed elastic fluids exist together, and to insist upon what I think a very important and fundamental position in the doctrine of such fluids;—namely, that the elastic or repulsive power of each particle is confined to those of its own kind; and consequently the force of such fluid, retained in a given vessel, or gravitating, is the same in a separate as in a mixed state, depending upon its proper density and temperature. This principle accords with all experience, and I have no doubt will soon be perceived and acknowledged by chemists and philosophers in general; and its application will elucidate a variety of facts which are otherwise involved in obscurity.

The objects of the present essay are,

1. To determine the weight of each simple atmosphere, abstractedly; or, in other words, what part of the weight of the whole compound atmosphere is due to azote, what to oxygen, &c. &c.

2. To determine the relative weights of the different gases in a given volume of atmospheric air, such as it is at the earth's surface.

3. To investigate the proportions of the gases to each other, such as they ought to be found at different elevations above the earth's surface.

To those who consider the atmosphere as a chemical compound, these *three* objects are but *one*; others, who adopt my hypothesis, will see they are essentially distinct. With respect to the first: it is obvious, that, on my hypothesis, the density and elastic force of each gas at the earth's surface are the effects of the weight of the atmosphere of that gas solely, the different atmospheres not gravitating one upon another; whence the first object will be obtained by ascertaining what share of elastic force is due to each gas in a given volume of the compound atmosphere; or, which amounts

---

* From *Manchester Transactions*, second series, vol. i.

ng, by finding how much the given
under a constant pressure, by the
s ingredients singly. Thus, if it
xtracting the oxygenous gas from
c air, the whole was diminished
g subject to a pressure of 30 inches
ght to be inferred that the oxyge-
the earth with a force of 6 inches

he second point, it will be further
pecific gravity of each gas ; that is,
given volume of each in a pure
e pressure and temperature. For,
any given portion of atmospheric
ound ratio of its force and specific

third object, it may be observed,
are specifically the heaviest must
ickest in ascending. If the earth's
homogeneous elastic fluid of the
ten times the specific gravity, it
ated that no sensible portion of it
ummits of the highest mountains.
tmosphere of hydrogenous gas, of
d support a column of mercury
ummit of Mount Blanc.
stantly found in every portion of
such quantities as are capable of
otic, oxygenous, aqueous vapour,
s probable that hydrogenous gas
it, but in so small proportion as
ny test we are acquainted with:
ounded in the large mass of azotic

xygenous and Azotic Atmospheres.

been used to determine the quan-

ous gas and air over water.
liquid sulphuret of potash or lime,
.
n gas and air by electricity.
o a solution of green sulphat or
r strongly impregnated with ni-

s in the air.

In all these cases the oxygen enters into combination and loses its elasticity; and if the several processes be conducted skilfully, the results are precisely the same from all. In all parts of the earth, and at every season of the year, the bulk of any given quantity of atmospheric air appears to be reduced nearly 21 per cent. by abstracting its oxygen. This fact, indeed, has not been generally admitted till lately; some chemists having found, as they apprehended, a great difference in the quantity of oxygen in the air at different times and places; on some occasions 20 per cent. and on others 30 and more, of oxygen are said to have been found. This I have no doubt was owing to their not understanding the nature of the operation, and of the circumstances influencing it. Indeed, it is difficult to see, on any hypothesis, how a disproportion of these two elements should ever subsist in the atmosphere.

As the first of the processes above mentioned has been much discredited by late authors, and as it appears from my experience to be not only the most elegant and expeditious of all the methods hitherto used, but also as correct as any of them when properly conducted, I shall, on this occasion, animadvert upon it.

1. Nitrous gas may be obtained pure by nitric acid diluted with an equal bulk of water poured upon copper or mercury; little or no artificial heat should be applied.—The last product of gas this way obtained does not contain any sensible portion of azotic gas; at least, it may easily be got with less than 2 or 3 per cent. of that gas. It is probably nearly free from nitrous oxide also, when thus obtained.

2. If 100 measures of common air be put to 36 of pure nitrous gas in a tube 3-10ths of an inch wide and 5 inches long, after a few minutes the whole will be reduced to 79 or 80 measures, and exhibit no signs of either oxygenous or nitrous gas.

3. If 100 measures of common air be admitted to 72 of nitrous gas in a wide vessel over water, such as to form a thin stratum of air, and an immediate momentary agitation be used, there will, as before, be found 79 or 80 measures of pure azotic gas for a residuum.

4. If, in the last experiment, *less* than 72 measures of nitrous gas be used, there will be a residuum containing oxygenous gas; if *more*, then some residuary nitrous gas will be found.

These facts clearly point out the theory of the process: the elements of oxygen may combine with a certain portion of

twice that portion, but with no
In the former case nitric acid is the
ous acid: but as both these may be
, one part of the oxygen going to
l another to two, the quantity of
ould be variable; from 36 to 72
ir. This is the principal cause of
so much appeared in the results of
t. In fact, all the gradation in
from 36 to 72 may actually be ob-
air of the same purity: the wider
xture is made in, the quicker the
and the more exposed to water, the
nitrous acid, and the less of nitric,

the purpose of eudiometry, there-
form nitric acid or nitrous wholly,
f the other. Of these the former
nents to be most easily and most
order to this, a narrow tube is ne-
wide enough to let air pass water
e to be agitated, is best. Let little
sufficient to form nitric acid be
us gas; let no agitation be used;
ution appears to be over for a mo-
as be transferred to another tube,
it any further diminution of con-
f the loss will be due to oxygen.—
essary to prevent the nitric acid
ith the water, from absorbing the
gas to form nitrous acid.
a good test of the proportion of
re, provided the liquid be not more
for the gas (atmospheric air): if
ere is a portion of azotic gas im-
n in quantity.
ery accurate as well as elegant and
o Monge, 100 oxygen require 196
ccording to Davy, 192; but from
vations of my own, 185 are suffi-
ir I always find 60 per cent. dimi-
n excess of hydrogen; that is, 100
drogen become 100 after the ex-
s found in the residuum: here 21

2. Of

2. *Of the Weight of the Aqueous Vapour Atmosphere.*

I have, in a former essay, (Manchester Mem. vol. v. p. 2, page 559,) given a table of the force of vapour in vacuo for every degree of temperature, determined by experiment, and in the sequel of the essay have shown that the force of vapour in the atmosphere is the very same as in vacuo, when they are both at their utmost for any given temperature. To find the force of aqueous vapour in the atmosphere, therefore, we have nothing more to do than to find that degree of cold at which it begins to be condensed, and opposite to it in the table above mentioned will be found the force of vapour. From the various facts mentioned in the essay, it is obvious, that vapour contracts no chemical union with any of the gases in the atmosphere; this fact has since been enforced in the Annales de Chimie, vol. xlii. by Clement and Desorme.

M. De Saussure found by an excellent experiment, that dry air of 64° will admit so much vapour as to increase its elasticity $\frac{1}{54}$th.—This I have repeated nearly in his manner, and found a similar result. But the table he has given us of aqueous vapour at other temperatures is very far wrong, especially at temperatures distant from 64°.—The numbers were not the result of direct experiment, like the one above.—If we could obtain the temperatures of all parts of the earth's surface, for any given time, a mean of them would probably be 57° or 58°. Now, if we may suppose the force of vapour equivalent to that of 55°, at a medium, it will, from the table, be $=$ to ·443 of mercury, or nearly $\frac{1}{70}$th of the whole atmosphere. This, it will be perceived, is calculated to be the weight of vapour in the whole atmosphere of the earth. If that incumbent over any place at any time be required, it may be found as directed above.

3. *Of the Weight of the Carbonic Acid Atmosphere.*

From some observations of Humboldt, I was led to expect about $\frac{1}{100}$dth part of the weight of the atmosphere to be carbonic acid gas: but I soon found that the proportion was immensely overrated. From repeated experiments, all nearly agreeing in their results, and made at different seasons of the year, I have found, that if a glass vessel filled with 102,400 grains of rain water be emptied in the open air, and 125 grains of strong lime water be poured in, and the mouth then closed; by sufficient time and agitation, the whole of the lime water is just saturated by the acid of air. But 125 grains of the grain measures of carbonic acid e, the 102,400 grain measures of carbonic acid, or $\frac{1}{1460}$th of the carbonic acid atmosphere then compound as 1 : 1460; but the s in a given portion of air at the $\frac{1}{1000}$dth of the whole; because gas is 1½ that of common air. e air in an assembly, in which breathed for two hours, with the contained little more than 1 per

the force with which each at- arth's surface, or in other words t to inquire into their specific

e following table.

-	-	1·000
-	-	·966
-	-	1·127
s	-	1·500
	-	·700
s -	-	·077*

e my authorities for these num- s and aqueous vapour. For the r. Davy's Chemical Researches; greater than theirs: I prefer it, with at least equal attention to it has this further claim for cre- this specific gravity, mixed with ake a compound of exactly the e atmosphere, as they evidently the unfounded notion of their ound. The specific gravity of ermined myself, both by analytic er the manner of De Saussure; ueous vapour of a known force ir, and weighing the water ob- ven weight of water to dry air, h the increased elasticity. De ic gravity to be ,71 or ,73; but.

---

en must be rated too low: if 100 oxygen , according to this 89 oxygen would re- ater; whereas 85 require 15. Hydrogen rt of the weight of common air.

he used caustic alkali as the absorbent, which would extract the carbonic acid as well as the aqueous vapour from the air. From the experiments of Pictet and Watt, I deduce the specific gravity of aqueous vapour to be ,61 and ,67 respectively. Upon the whole, therefore, it is probable that ,7 is very nearly accurate.

We have now sufficient data to form tables answering to the two first objects of our inquiry.

I. *Table of the Weights of the different Gases constituting the Atmosphere.*

	Inch. of mercury.
Azotic gas	23·36
Oxygenous gas	6·18
Aqueous vapour	·44
Carbonic acid gas	·02
	30·00

II. *Table of the proportional Weights of the different Gases in a given Volume of Atmospheric Air, taken at the Surface of the Earth.*

	per cent.
Azotic gas	75·55
Oxygenous gas	23·32
Aqueous vapour	1·03*
Carbonic acid gas	·10
	100·00

III. *On the Proportion of Gases at different Elevations.*

M. Berthollet seems to think that the lower strata of the atmosphere ought to contain more oxygen than the upper, because of the greater specific gravity of oxygenous gas, and the slight affinity of the two gases for each other. (See Annal. de Chimie, tom. xxxiv. p. 85.) As I am unable to conceive even the possibility of two gases being held together by affinity, unless their particles unite so as to form one centre of repulsion out of two or more (in which case they become one gas), I cannot see why rarefaction should either decrease or increase this supposed affinity. I have little doubt, however, as to the fact of oxygenous gas observing a diminishing ratio in ascending; for, the atmospheres being independent on each other, their densities at different heights must be regulated by their specific gravie azotic atmosphere as a standard, rbonic acid will observe a decreasing, and the aqueous vapour an ecific gravity of oxygenous and o 6 nearly, their diminution in t heights reciprocally as their spewould be found, that at the height three English miles), the ratio of in a given volume of air, would consequently it follows that at any rence in the proportions will be le*.

---

* The proportion of aqueous vapour must be understood to be variable for any one place: the others are permanent, or nearly so.

---

the Torpedo, by Messrs. HUMSSAC. Extracted from a Letter o M. BERTHOLLET, dated Rome,

tric fish ought to be the subject of vith a view to the opinion of many ive that they are capable of being iples of that beautiful theory with l science. You well know, my ust have been our anxiety to prou will perhaps be astonished that vriting to you respecting it. At them, but we were then without Vecchia we searched for them in our stay at Naples, we procured great size, and very vigorous. I is letter, the series of experiments d I have instituted upon the action pedo of Linnæus). M. de Buch, vas present at our experiments. I s which they afforded, and relate cing any theoretical notions.

principally intended to discover the torpedo is unable to commu-

---

nit of Helvelyn, in Cumberland (1100 yards 26,60), in July 1804, gave no perceptible Manchester. M. Gay-Lussac determines om an elevation of four miles to be the same

. 166.

nicate those shocks termed electric, although the feeling is very different from that which is occasioned by the discharge of a Leyden phial. Having at hand no other work besides that of Aldini, in which he has combined into one view the beautiful researches of Geoffroy with those of Spallanzani and Galvani, we shall not have it in our power to compare our own labours with those of preceding philosophers.

1. Although the power of the torpedo cannot be compared to that of the gymnotus, it is not less capable of occasioning disagreeable sensations. A person much in the custom of receiving electric shocks, supports with some difficulty the shock of a torpedo 14 inches long, and in a state of perfect vigour. The gymnotus communicates its influence under water, unless when much weakened.

M. Gay-Lussac has observed, that the action of the torpedo in this condition is not perceptible until it is raised above the surface of the water. It is with this fish, as with frogs on which Galvanic experiments are made: the circumstances under which the contraction takes place, vary according to the degree of excitability in the organs.

2. I have remarked, while in South America, that the gymnotus gives the most frightful shocks without making any external motion of the eyes, head, or fins: it moves no more than one person communicating an idea or sensation to another. But the torpedo, on the contrary, moves its pectoral fins in a convulsive manner before each shock; and the violence of the stroke is always proportioned to the extent of the surface of contact.

3. The organs of the torpedo, or gymnotus, cannot be discharged by us at will, like a Leyden phial or a Galvanic pile; nor does the electric fish uniformly communicate a shock when touched. It must be irritated that it may give its stroke; for this action depends upon the will of the animal, which in all probability does not always keep its electric organs charged: it charges them, however, with astonishing celerity, and is thus able to give a long series of shocks.

4. The shock is felt, provided the animal is disposed to give it, when a single finger is applied to a single surface of the electric organs; or when the two hands are placed one on the upper and the other on its under surface at the same time. And in either of these cases the shock is equally communicated, whether the person be insulated or not.

5. If a person while insulated touches the torpedo with his finger, it is indispensably necessary that the finger be in

shock is communicated when a
piece of metal, is interposed
organs of the fish. Thus we
a key, or other metallic instru-
ock in consequence.
g observed this important fact,
plate of metal, so that the in-
organs was in contact with the
pported the plate felt no shock,
a state of insulation irritated the
vulsive motions of its pectoral
powerful discharges of its elec-

rson support the torpedo placed
is left hand as in the preceding
ght touches the upper surface of
iolent shock is felt in both arms

experienced when the fish is
of metal, the edges of which do
applies a hand to each plate at

ing experiment there exists an
between the edges of the two
the arms; for in this case the
n the two surfaces of the organ
d the new communication esta-
hands to the plates becomes al-

ectrometer does not indicate the
organs of the torpedo: it is no
d which we can have recourse to,
o the organs, or by insulating
plate of metal, and then form-
eans of a wire between the plate
a. Nothing shows here, as in
nimal can modify the state of
odies.
while in a state of health with
r as in the air, we examined the
is fluid. A number of persons
nnection between the upper and
ns of the torpedo, no shock was
oistened their hands with water.
hen two persons who have their
orpedo, instead of taking hold of
each

each other's left hands, plunge a pointed piece of metal into a drop of water placed upon an insulating body.

12. By substituting flame instead of a drop of water, the communication is interrupted, and no sensation is experienced until the two pieces of metal touch each other within the flame.

13. We must also observe that no shock will take place either in air or under water, unless we immediately touch the body of the electric fish. They are unable to give their stroke through a layer of water, however thin; a fact which is the more remarkable, as we know that in Galvanic experiments, where the frog is placed under water, it is sufficient to bring the silver forceps near to the muscles, and that the contraction takes place when the layer of water interposed is one or two millimetres in thickness.

Such, my respected friend, are the principal observations which we have made upon the torpedo. Experiments 4th and 10th prove that the electric organs of these animals manifest no tension or excess of charge. We should rather be inclined to compare their action to a chain of small Leyden phials than to the pile of Volta. As some communication is always necessary for the occurrence of a shock, and having received strokes from the gymnotus through very dry cords, I conclude that in the case where this powerful animal appeared to give these violent shocks without the existence of any communication, it must have arisen from my imperfect insulation. If the torpedo acts by poles, by an electrical equilibrium which tends to reestablish itself, experiments 5th and 6th seem to prove that these poles exist near one another upon the same surface of the organ: for we feel the shock by touching a single surface with the finger. A plate interposed between the hand and the organ (6.) re-establishes of itself the equilibrium, and the hand which supports this plate feels nothing, because it is out of the current of the electric influence. But if we suppose a number of poles of different descriptions upon each surface of the organ, why is it that, by covering these with two metallic plates the edges of which do not touch, and placing the hands upon these plates, the equilibrium is re-established through the medium of the arms? Wherefore, it may be asked, does not the positive electricity of the inferior surface seek, at the moment of explosion, the negative electricity of the neighbouring pole? and wherefore does it find it only in the superior surface of the electric organ? These difficulties are perhaps not in-

surmountable,

ry of these *vital actions* requires
eoffroy* has proved that rays,
marks of electricity, possess or-
ose of the torpedo. The least
s animal prevents its electrical
efore, without doubt, act the
1 of these phænomena; and the
eneral and enlarged view of the
reason oppose the ideas of the
s he can explain the whole by
o-gelatinous pulp with the ten-
has combined in the formation
).

respecting New Books.

ictions of the Royal Society of
, contain the following papers:
s on a Diurnal Variation of the
pics. By J. Horsburgh, Esq.—
ice in the Magnetic Needle, on
sing from an Alteration in the
d. By Matthew Flinders, Esq.
y's Ship Investigator.—3. The
ne of the Bones of the Organ
n a comparative View of its
ferent Animals. By Anthony
. On an Artificial Substance
al characteristic Properties of
ett, Esq. F.R.S.—5. The Case
whom the Ovaria were deficient.
S.—6. A Description of Mal-
f an Infant. By Mr. Hugh
1 a Method of analysing Stones
means of the Boracic Acid.
F.R.S.—8. On the Direction
of the Sun and Solar System.
D. F.R.S.—9. On the Repro-
omas Andrew Knight, Esq.
it of Two Mummies of the
h was in a remarkably perfect

State.

---

ee Phil. Mag. vol. xv. p. 126.

State. By John Pearson, Esq. F.R.S.—11. Observations on the singular Figure of the Planet Saturn. By William Herschel, LL.D. F.R.S.—12. On the Magnetic Attraction of Oxides of Iron. By Timothy Lane, Esq. F.R.S. —13. Additional Experiments and Remarks on an Artificial Substance, which possesses the principal characteristic Properties of Tannin. By Charles Hatchett, Esq. F.R.S.—14. On the Discovery of Palladium, with Observations on other Substances found with Platina. By William Hyde Wollaston, M.D. F.R.S.—15. Experiments on a Mineral Substance, formerly supposed to be Zeolite, with some Remarks on Two Species of Uran-glimmer. By the Rev. William Gregor.

Several of the above papers have been laid before our readers in our last and in the present number.

The Royal Society of Edinburgh has published the conclusion of its 5th volume. It contains the following papers: 1. On the Origin and radical Sense of the Greek Prepositions. By Mr. James Bonner.—2. Experiments on the Contraction of Water by Heat, at low Temperatures. By Dr. Thomas Charles Hope (published in our present volume, p. 153).—3. The History of the Society, consisting of the following Articles:—Diurnal Variations of the Barometer. By Mr. Playfair.—Aurora Borealis observed in Day-Light. By the Rev. Dr. Patrick Graham.—Phænomenon of Two Rainbows intersecting one another. By Mr. Playfair.—On the Combustion of the Diamond. By Sir George Mackenzie, Bart.—Remarks on the Basalts of the Coast of Antrim. By the Rev. Dr. Richardson.—Rule for reducing a Square Root by a continued Fraction. By James Ivory, Esq.—Singular Variety of Hernia. By Mr. Russel.—Concerning the Chartreuse of Perth. By the Abbé Mann.—Explanation of the Old Word Skull or Skoll. By the Rev. Dr. Jamieson.—Biographical Account of the late Dr. James Hutton. By Mr. Playfair.—Minutes of the Life and Character of Dr. Joseph Black. By Dr. Ferguson.—Appendix.—List of Members elected since the Publication of the last Volume.—List of Donations.

The Literary and Philosophical Society of Manchester, to which the philosophical world was before indebted for a number of valuable papers published at different periods, in five volumes, has just published another volume, being the first of a new series. Its contents are:—1. An Essay Physiological and Experimental on the Effects of Opium on the

Living

liam Alexander, M.D.—2. On
cient Epic Poem. By the Rev.
Observations on the Effect of
of Animals. By Mr. B. Gibson.
se of Popular Sports and Exer-
the Greeks and Romans, as a
. Bardsley, M.D.—5. Reverie;
vith Literature; an Essay. By
B.—6. Experimental Inquiry into
al Gases or Elastic Fluids consti-
y John Dalton.—7. On the Ten-
Diffusion through each other.
e Absorption of Gases by Water
hn Dalton.—9. A Description of
c or Indian Rubber; with some
the Elasticity of this Substance.
By Mr. John Gough.—10. An
ixed Gases, and on the State of
e. By Mr. J. Gough.—11. On
the Skulls of Animals. By Mr.
Moral Influence of History. By
.S.—13. Reflections on History
t and Modern. By John Hol-
d Moral Philosophy; and the
phizing in both. By the Rev.
A Reply to Mr. Dalton's Objec-
ixed Gases. In a Letter from
By Mr. John Gough.—16. Re-
wo Essays on the Doctrine of
essor Schmidt's Experiments on
d Moist Air by Heat. By John

* * *

in, has published the prospectus
shortly to lay before the public,
ly prove highly useful to calico
join a translation of the

SPECTUS.

ix years, made the art of dyeing
bject of my labours, I have suc-
siderable number of new mor-
ost beautiful and lasting colours
l linen goods; likewise in pro-
or copper-plate printing, and a
d shades, for pencilling, which,
in

in regard to beauty and quality, will leave but little room for further exertions.

The time bestowed on these objects, and the expenses required for numberless trials, impose upon me the duty of endeavouring to obtain a moderate restitution for both. I have therefore resolved to publish my discoveries under the title of "Discoveries and Inventions for preparing new Mordants for Cotton and Linen, in order to produce beautiful and lasting Colours; with Instruction for producing genuine Colours both for Block and Copper-plate Printing, as also for Pencilling in all Shades."

The whole will be divided under the following heads;

1. Instructions for determining and preparing such substances as are required for the production of new mordants, and colours for printing and pencilling.
2. Instructions for compounding new mordants.
3. Instructions for compounding genuine and beautiful colours for printing in all tints and shades.
4. Instructions for compounding genuine and beautiful colours of all tints for pencilling.

To those who confide in my abilities and character, I offer this work, by way of subscription, at the price of three guineas; and at the expiration of March 1806 the subscription will be closed, when the printing of it will take place, and the price to non-subscribers will then be five guineas.

Berlin,
Dec. 13, 1805.

S. F. HERMBSTAEDT.

Subscribers in London, or other parts of Britain, are requested to apply, post paid, to Mr. J. Hunneman, No. 6, Frith-street, Soho, where subscriptions will be received, and proper receipts given. Such as are not masters of the German language, are informed that a translation of the above work will be undertaken by

J. HUNNEMAN.

LXIX. *Proceedings of Learned Societies.*

ROYAL SOCIETY OF LONDON.

On the evening of Thursday, the 9th instant, this society assembled after the Christmas holidays, the right honourable Sir Joseph Banks, bart. president, in the chair. A summary of Mr. Brandé's experiments on guaiacum, as mentioned in our last month's report, was read. In 100 grains of

g to the analysis of this inge-
(as near as we can recollect)
; of empyreumatic oil about 30;
ated hydrogen gas about 8. In
ced a solution of guaiacum that
e of caout-chouc, but when re-
ecame brittle. Of the chemical
experiments there cannot be the
the present rested content with
sis, without entering into a de-
principles of this vegetable pro-
y properly given the generic de-
sin. From these experiments,
arches of the very accurate and
we may shortly expect to pos-
e nature and properties of gums,

mmenced the reading of a letter
the right honourable Sir Joseph
the roots, and the elongation of
e right honourable President who
r who executes these vegetable
e public is deeply indebted; and
the exception of Hedwig, is al-
urope who seems to be convinced
but as it is connected with the
nd the anatomy of vegetables.
occupied with fruitless and dis-
rminology, this naturalist mo-
s of vegetation, the true philo-
rdour, originality, and accuracy
eventually produce the most be-
ociety. We would not deprive
r of presenting the public with
s in his own terms, by antici-
ntages to agriculture in deve-
administering the most proper
ood necessary to facilitate the
ze of those plants which are in-
nce.

ourable the President in the
Ir. Knight's excellent paper on
mination. To determine whe-
s of plants was the effect of an
consequence of mechanical gra-
different seeds in boxes attached

to two wheels, one of which was horizontal, and the other vertical, turned by a rivulet that runs through his garden. One of these wheels performed 150 and the other 250 rotations in a minute; a velocity which rendered the power of gravitation equal on both sides of the seed, and produced, as the author had expected, the protrusion of roots and elongation of germs in all directions. From several very decisive experiments to elucidate this fact, he concludes, contrary to Du Hamel, that gravitation is the sole cause of the descent of roots and ascent of germs, and that both diverge in all directions when under the influence of equal pressure. His observations also refute the too common notion that the roots of plants have an affinity for water, or rather that water attracts them from their accustomed direction by the nutriment which it affords. Mr. K. confirms, however, the generally received opinion of the affinity of plants for light. On the reputed tap-root of oaks he observes, that, after examining above 2000 trees, not one of which had such a root, he thinks he shall be pardoned for concluding that it has no existence. Of these interesting experiments we shall only observe, that, although the naturalist has carefully noted the time taken by the different seeds to germinate in the horizontal and vertical wheels, he has not mentioned what time would have been necessary for the same purpose in similar earth subject to the usual effect of gravitation. Such a comparison made with seeds of all the different qualities capable of vegetating, might develop some facts important to our present system of husbandry. On the same evening also commenced the reading of a "Third Communication on Artificial Tannin, by Mr. Hatchett."

January 23, the right honourable the President in the chair. Continuation of the above communication. Mr. Hatchett found that all gums, resins, and balsams, yield this artificial tanning substance on being treated with nitric acid, as observed in his preceding papers. It appears that all these substances yield at one operation a certain quantity of this matter; but if the process be continued too long the product is destroyed, the same as the natural tannin is by nitric acid. Mr. Hatchett was not able to ascertain either the specific quantity produceable at once, nor the precise time requisite to disengage the greatest possible quantity without injuring the entire product. The author, animated with this complete success on resinous substances, has pursued his researches on a vast variety of vegetable productions; whence it appears, that almost all vegetables, after

zed and treated with nitric acid,
substance; and that oak-bark,
in in the tanners' pits, by being
ted, and as often subjected to
tally convertible into artificial
re also transmutable in a similar
.

lusion of this paper was post-
ary.

F ANTIQUARIES.

nments of this society being the
he Royal, it of course assembled

resident, sir H. C. Englefield,
A drawing of a spear-head found
on, Nottingham, in 1803, was
t is evidently of Roman origin;
of its having been so long in the
ured or rusted, the learned an-
been made of Corinthian brass.
scribed in the ninth volume of
sidered as Roman manufacture.
r qualities and composition of
learned and truly philosophical
published in the Transactions of
will afford the most satisfactory
ry accurate chemical analysis of
s that these Roman instruments,
ound in various parts of Eng-
monly alleged, but an alloy of
portion of about 10 parts of the
, the specific gravity of which
oy, indeed, after a number of
any thing but chemical, flattered
at they were an alloy of copper
n might have been philosophical
om the researches of Dr. Pearson
was made by some French che-
on of which was published in the
the Philosophical Magazine.
ances that render an intimate
ar alloy so much in use with
eresting to the English anti-
omans, when they overran this
t Britons how to manufacture
this

this most useful metal. In that case, the antient importance and use of English tin must have been much greater than hitherto supposed. But there is a more modern use of this alloy, which antiquaries have almost wholly overlooked or very imperfectly understood, and to which we should beg leave to call their attention: we mean those engraved plates on tomb-stones, and sarcophagi, vulgarly called brass, and many of them actually are of that metal; but there are more, especially of those made in the 12th, 13th, and 14th centuries, of this gun-metal, or an alloy of copper and tin. The churches at St. Albans *, Watford, &c. and almost all parts of England, contain tombs decorated with these plates, supposed, perhaps erroneously, to be of Flemish manufacture. It is not improbable, indeed, that those which are made of brass, and which are almost entirely consumed with rust, may be of foreign origin, while those made of copper and tin have withstood the action of the humid atmosphere of vaults upwards of four centuries, without any indication of oxidation or consumption by rust.

On the same evening the indefatigable Mr. Lysons furnished some curious items respecting the origin and history of sugar. It appears that the antients had nothing but honey; and that, till about the year 620 of the present æra, sugar-cane was wholly unknown. The discovery is ascribed to a Venetian, who called it cane-honey. It is not above 200 years since refined sugar was first introduced into Europe from China by the Portuguese and English.

January 16, the vice-president, sir H. C. Englefield, bart. in the chair. Several curious extracts from his majesty's records in the Tower, by Mr. Lysons, were read, on the prices of drugs and medicines during the reigns of the first Edwards.

January 23, the right honourable the earl of Leicester, president, in the chair. A letter from Mary de Medicis, queen of France, to her daughter, Henrietta Maria, queen of Charles the First, was exhibited by Dr. Garthshore. It contained nothing particular, but merely a recommendation of the bearer to her daughter's attention. According to the usage of that period (1636) it was sealed with two seals united by a narrow tape or ribbon. Several other miscellaneous letters were read, but which were of a nature and importance that do not call for particular notice.

---

* See Brayley's Beauties of England and Wales.

TY, BOROUGH OF SOUTHWARK.

ll times to be able to record the
the diffusion of knowledge; and
n we announce that one has been
vhich promises to prove useful.
house of Mr. Snart, optician, 215
promoter of, and diligent inquirer
d with natural philosophy.

ALEXANDRINUM.

urgh of the 22d December last,
imber of persons have united to
the above name, for the purpose
works of art of *all kinds*, and to
on of the best scientific works and
eans to publish its transactions.

Y OF SCIENCES, HAARLEM.

rs are extracted from the program
1805:
ceived, upon the question which
ntaining the principal facts that
ght to light by the electric pile of
ous experiments made to ascertain
Dutch, having for motto *Men*
They have adjudged that this
the talents of its author, but that
ze. They have therefore deter-
stion; the answer to be given in
er 1806.
pon the question—"What are the
istory of fire, respecting the pro-
and confinement of heat, requi-
t œconomical mode of employing
oses of heating; and how may we
e principles, chimneys for warm-
ves in kitchens, with a view to
, the fuel which is in common
r in German, having for motto,
turæ insatiabilis quædam e cog-
&c. Cicero. This memoir ap-
exactly to the question proposed,
ously adjudged to it. On opening
nied it, the author was found to
of Brunn, in Moravia.

3. They have received upon the question,—"What is at present known of the causes which occasion the corruption of stagnant water? and are we able to discover, from the knowledge we possess upon this subject, or from any thing that can be proved by decisive experiments, the most effectual, and at the same time innocent, means of preventing the corruption of stagnant water?" two memoirs; the one in Dutch, having for motto, *Neque vero negligentiam*, &c. Hipp.; the other in French, having as motto, *Magnam artis partem*, &c. Hipp. They have determined to repeat the question. The answer to be given in before the 1st of November 1806.

4. They have received upon the question,—"What light has the new chemistry thrown upon the physiology of the human body?" a memoir in Dutch, having for motto, *Vita brevis, ars longa*, &c.; which was judged too superficial to receive the prize.

They have received also upon this question, and upon the two following:

5. "How far has the light thrown by the new chemistry upon the physiology of the human body contributed to improve the knowledge of certain diseases? and what useful consequences, in any degree confirmed by experience, can we deduce from it in the practice of medicine?"

6. "How far has the new chemistry tended to furnish precise notions with regard to the actions of certain external and internal remedies which have been either long in use or revived anew? and what advantages can we derive from a more exact knowledge of these actions in the treatment of certain diseases?" memoirs in French, having for motto, *Est modus in rebus*.

The society have determined to propose the following questions: candidates to deliver their answers by the 1st of November 1806:

"1. How far has chemistry explained the principles or component elements of plants, and more especially of such as furnish food? and what conclusions can we draw, either from the knowledge which we already possess upon this subject, or from what we can discover by experiment, aided by our knowledge of physiology, with regard to the vegetables which are best suited to the support of the human body both in health and in some diseases?"

"2. Are we enabled, by our present knowledge of the elements composing the food of animals, to explain satisfactorily the origin of the several principles or constituent parts of the human body; as for example, of the cal-

sphorus, iron, &c.? or are these
the animal body in some other
riments and observations which
hat at least some of those prin-
ble to compose or analyse them
oduced by a peculiar action of
e the author should adopt in his
will be sufficient that he prove
c of the above-mentioned prin-

which our experience has satis-
ng the acceleration of the ger-
Humboldt first attempted by
riatic acid :—as well as regard-
des common manures and heat,
d to forward the vegetation of
germination in particular? how
physiology of plants, in what
what assistance can we derive
this point, in our further re-
e. means already had recourse to
vantage can we reap from the
this subject, in the cultivation

continue to be proposed for an

nt by experience respecting the
which are apparently noxious,
tries? and what precautions are
eir extirpation?"
nous plants hitherto least known
ay be advantageously admitted
which may supply the place of

society expects upon this ques-
y the virtues and advantages of
according to testimonies from
according to proofs and observa-
own provinces.
lants, hitherto not in use, can
es of wholesome nourishment at
ient plants from other countries
the same view?"
lants, hitherto not used as dyes,
ording to accurate experiments,
on and use of which might be
introduced

introduced with advantage? and what foreign plants might be profitably cultivated in the more barren and waste lands of this republic, with a view to the extraction of dyes?"

The society repeat again, that according to the decree passed in the anniversary sitting of 1798, they will consider at each anniversary sitting the papers that have been communicated since the last meeting, which are not answers to questions proposed by the society; and that if there be found among them one treating of some branch of physics, or natural history, which merits a particular reward, they will adjudge to that memoir, or, if there be several of them, to the paper which shall appear most interesting, a silver medal having the usual device of the society, and in addition a gratification of ten ducats.

The answers may be made in Dutch, French, Latin, or German, but only in Roman characters: they must be accompanied by a sealed letter containing the name and address of the author, and sent to M. Van Marum, secretary to the society.

The prize destined for the memoir, which in the opinion of the society shall contain the best answer to any one of the questions above mentioned, is a gold medal, having the usual device of the society, and on the border the name of the author, with the year in which he received the prize, or thirty ducats, at the option of the person to whom the medal shall have been decreed.

LXX. *Intelligence and Miscellaneous Articles.*

VACCINATION.

By a calculation of ten years from January 1st 1791 to January 1st 1801, it appears that the average number of deaths at Vienna was 14,600, out of which were 835 children of the small-pox. In 1801, the period in which vaccination began to be introduced, out of 15,101 only 164 children fell victims to the small-pox: in 1802, out of 14,522 only 61: in 1803, the number out of 14,385 was only 27: and in 1804, out of 14,035, no more than 2.

At one of the late meetings of the original Vaccine Pock Institution, Broad-street, Golden-square, the subject of the antivaccine publications was discussed; and it was determined, that whatever unfortunate events might have occurred, the practice at this institution was uniformly as favourable, with regard to the fact of security against the small-pox, as could be expected from variolous inoculation.

But

e communication of failures, and
o the public, of confidence, the
directed to be offered to each
ing it just to employ the small
isabusing the public with regard to
dverse satisfactory evidence can be
in establishing the new practice.

e Pock Institution, Broad-street,
quare, January 17, 1806.

. C. aged two months, residing
inated at this institution as re-
o.

case the aforesaid E. C. shall
me being satisfactorily proved on
by three or more of the medical
he shall be entitled to the sum of
s of the institution, on the pre-
; to be paid at the first quarterly
pplication.

be sent to the secretary at the
earance of the small-pox.

onial for the purpose of claim.

George Pearson, M.D.
Thomas Nelson, M.D.
John Doratt, Surgeon.

RONOMY.

usion and Declination of Ceres
r February 1806.

	Juno.	
c. N.	A.R.	Dec.
′	h m s	° ′
6	11 42 40	1 18 S.
11	11 41 32	1 1
16	11 40 12	0 41
19	11 38 40	0 19
22	11 37 0	0 4 N.
24	11 35 8	0 28
25	11 33 8	0 54
26	11 31 4	1 21
26	11 28 52	1 48

ow to be seen.

COMET.

COMET.

On the 22d of October, M. Huth, of Frankfort on the Oder, at three o'clock in the morning, discovered a comet in the hindermost foot of the Great Bear, betwixt the stars ν and ξ. It could hardly be seen with the naked eye, but was very visible with a common telescope. In size and brightness it resembled the great nebulous spot in Andromeda, except that it was almost circular. At four A. M. its right ascension was about 166° 30′, with 30° 40′ declination north; and in an hour after, the former was 166° 32′, and the latter 33° 32′. Its course is therefore southerly, and somewhat westerly. When magnified 350 times, it did not show any nucleus.

The same comet was discovered on the following day by professor Bode, at Berlin, between two and three o'clock in the morning, at ȣ of the Great Bear. Right ascension 174° 25′, and 270° 40′ north declination.

WOOD.

The following particulars are transcribed from a letter of John Templeton, esq. published in the third volume of the Transactions of the Dublin Society:

"It is said that there has been no timber found at Botany Bay but what sinks in water. The Robinia Pseudo-Acacia, or locust-tree of North America, is esteemed beyond all others for the durability of its timber, when exposed to the weather, and for making trennels or wooden pins for fastening the planks of ships. Luckily in light soils it thrives well in Ireland, and sends forth suckers by which it is easily propagated. It grows with great quickness; I have had some, which made shoots five and six feet in a season, in a sandy soil. They are not injured by our severest frosts; but care must be taken to place them in such situations as that they will not be exposed to high winds, which often break their branches.

The Fagus Castanea, or sweet chesnut, is among our most beautiful trees of quick growth in a sandy or light loamy soil. There are four on my farm of considerable size; one is above eleven feet in girt, growing rapidly; and yet there is reason to believe them about a hundred years old. The timber is esteemed the best of European growth, for a great variety of uses. In the southern parts it is preferred for wine casks, as it is not apt to warp or shrink. In England it is reckoned the best for hop-poles, as even young poles stand wet and dry better than any other. Its durability has been pretty well determined by an experiment related in Young's Annals of Agriculture.

"Inch and half planks of trees from thirty to forty-five years growth, after ten years standing in the weather, were examined, and found in the following state and condition:

Cedar, perfectly sound.
Larch, the heart sound, but sap quite decayed.
Spruce fir, sound.
Silver fir, in decay.
Scotch fir, much decayed.
Pinaster, quite rotten.
Chesnut, perfectly sound.
Abele, sound.
Beech, sound.
Walnut, in decay.
Sycamore, much decayed.
Birch, quite rotten.

Young's Annals of Agriculture, vol. vi. 256.

A piece of a branch cut off, and put in as a gate-post twenty-five years ago, is yet perfectly sound, even at the surface of the ground, a time that, I believe, would have rotted the best oak. Another property which recommends chesnut is, that it stains well, with a decoction of logwood and Brazil-wood, with alum water, varying the proportions at will. I have imitated mahogany so as to deceive most people.

MEDICAL AND CHEMICAL LECTURES.

On Thursday, February 6th, a Course of Lectures on Physic and Chemistry will recommence at the Laboratory, Whitcomb-street, Leicester-square, at the usual morning hours, by George Pearson, M.D. F.R.S. &c.

LIST OF PATENTS FOR NEW INVENTIONS.

To Joseph Fletcher, of Horsley, in the county of Derby, needle-maker; for a machine for raising water. Dated January 23, 1806.

To George Barton Alcock, of the city of Kilkenny, in that part of the united kingdom of Great Britain and Ireland called Ireland; for certain improvements in lamps. Dated January 22.

To John Dobbs Davies, of New Compton-street, in the county of Middlesex, gentleman; for a saddle bar on an improved construction, which he denominates the *motion saddle bar*. Dated January 22.

To Robert Berriman, of Speen, in the county of Berks, wheelwright; for a machine for preparing land for the reception of seed, which he is confident will prove of the utmost advantage to agriculturists in sowing corn, in producing a regular and more abundant crop, and in enabling the farmer, at an easier rate, to keep his land free from all kinds of weeds. Dated January 22.

METEOROLOGICAL TABLE,
BY MR. CAREY, OF THE STRAND,
For January 1806.

Days of the Month.	Thermometer.			Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
	8 o'Clock, Morning.	Noon.	11 o'Clock, Night.			
Dec. 27	34°	40°	32°	29·87	7°	Fair
28	34	40	44	·80	0	Rain
29	47	51	49	·82	0	Rain
30	51	52	53	·89	0	Rain
31	53	53	49	·82	5	Cloudy
Jan. 1	43	43	48	·70	5	Cloudy
2	36	39	35	·80	8	Fair
3	35	38	32	·82	6	Fair
4	33	41	49	·80	0	Rain
5	40	44	49	·88	12	Fair
6	49	53	46	·85	9	Cloudy
7	39	48	48	30·00	0	Rain
8	47	49	38	29·50	20	Fair
9	39	44	40	·57	18	Fair
10	36	41	35	28·72	17	Fair; a storm in the morning, with thunder
11	37	41	36	29·10	20	Fair
12	36	39	36	28·65	0	Rain
13	36	39	33	29·65	10	Fair
14	40	43	39	·60	12	Fair
15	41	45	45	·49	22	Fair
16	50	46	40	·01	0	Stormy
17	36	44	33	·70	21	Fair
18	38	44	49	·85	0	Rain
19	43	49	44	·68	24	Fair
20	51	54	47	·52	0	Rain
21	50	55	46	·82	15	Fair
22	49	53	46	·92	7	Cloudy
23	59	50	47	·90	23	Cloudy
24	48	51	40	·52	21	Fair
25	39	44	37	·60	24	Fair
26	35	41	36	·25	4	Cloudy

N. B. The barometer's height is taken at noon.

INDEX TO VOL. XXIII.

. On a variety of, 3
ethod of extracting
m beet root, 14
ie. Its utility in ana-
146
w one, 128
mic. Medicinal use
68
ic. Found in animal
264
. To prepare, 74
atic. Production of,
257, 285
. Action of, on ani-
ances, 255, 326
muriatic. Action of,
ide, 61
borous. Action of,
ry, 56
16, 26
ent, 374
North American. On,
143
burets. On decom-
70
prepare, from pyrites
65
ats of, 97
ers. Action of nitric
255, 326; fluoric
d in, 264
ent, 287
medicine for hogs,
24
Society of, 184,
270, 366
a genus of, 3
graving. On, 130
tent for, 191

Astronomy. 93, 190,
Atmosphere. On constit
Azimuth compass. Paten
Barlow's specific for
pitis,
Barometer. Variation
tween the tropics,
Baronia's Galvanic pile
Barton on North Amer
gator,
Baruel's apparatus for
nating gases,
Barytes. Sulphuret of
compose,
Batavian Society,
Berriman's patent,
Beet-root. To extract sug
Bevis. (Dr.) Life of,
Bile. Experiments on,
Biography, 76,
Blight. On,
Bombay Society,
Books. New,
Braamcamp on mercury,
Brandé on guaiacum,
British Institution for pr
the Fine Arts,
Brown's patent,
Bucholz on decomposing
of tin, 112; on nic
cobalt,
Byrne, the engraver. D
Calculous concretions. O

Candles. Patent for, 95
Carlisle on muscular motion, 113, 217; on muscles of fishes, 183
Carey's meteorological tables, 96, 192, 288, 375
Carriages. Patent for improving, 191
Cartwright on salt as a manure, and a condiment for animals, 16
Celtic Academy, Paris, 186
Ceres. On the planet, 93, 190, 284, 372
Ceruse. Preparation of, 94
Chancey on goats of Angora, 97
Charles's machine for levelling land, 309
Chemico-Galvanic observations, 129
Choak-damps in mines. To remove, 261
Cloths. Patent for, 287
Clubb's patent, 95
Cobalt. To obtain pure, 145; to separate, from nickel, 193
Colours which resist acids, 9
Comet seen, 269, 285, 373
Commercial policy. On, 104
Copal varnish. A useful, 13
Cordage. Patents, 191
Corn. On blighted, 346
Cotton. To dye, red, 228
Cows. Surgical operation on, 308; experiments on fattening, 25
Carr's patent, 191
Cutting instrument made of stone, 270

Dalton on constitution of the atmosphere, 349
Davies's patent, 374
Davy on analysis of soils, 26; on analysing stones, 146
Deaths, 94
Decline cured by vital air, 212
Desormeaux's patent, 95
Dispensaries. On the utility of, 312
Dize on decomposing sulphurets, 70
Dropsy. Cure for, 286
Dyeing wool. Roard on, 42
Dyeing. Process for, 228

Earthquake at Naples, 90
Egan on gravelly concretions, 199, 295
Enamel colours. Patent for, 287

Firminger. Comet discovered by, 285
Fire-damp in mines. To remove, 261
Fishes. On muscles of, 183
Fletcher's patent, 374
Flint's patent, 191
Fourcroy on action of nitric acid on animal matters, 255, 326
Fourcroy on blighted corn, 346
French National Institute, 184

Gall-nuts. Experiments on, 74
Galt on commercial policy, 104
Galvanism. Ritter's discoveries in, 51, 54; Oersted on, 129; production of muriates by, 257; pile of vegetable matters, 283
Gaseous oxide of carbon. Apparatus for, 317
Gases in atmospheric air. On, 349
Gay-Lussac on fluoric acid, 264
——— on the torpedo, 356
Germination. A prize question, 370
Gravitation has an influence on vegetation, 362
Gravelly concretions. On, 199, 295
Gregorian calendar restored in France, 87
Guaiacum. On, 269; analysis of, 364
Gums. Experiment on, 259
Gymnotus. Electric power of, 357

atent, 191
n artificial tannin, 173,
320, 365
s colour for making
oods, 8; varnish for
vessels, 13
lformation of the, 269
ed, 68
on figure of Saturn,
n solar system, 230
eriments on fattening,
nedy for diseases of,
24
nachine for shoe-ma-
102
eriments on contrac-
water by heat, 153
preserving, 189
on variation of baro-
etween the tropics,
289
furniture. Patent, 287
patent, 191
ly, constituent parts of.
uestion, 369
on the torpedo, 356
s patent, 95
enated muriate of mer-
n, 62
eton of, 191
Academy of Sciences,
rgh, 85
periments on, 255
le substance. A new,
255
atent, 287
ved of oxygen by tin,
gnetic attraction of
f, 253
&c. Patent for, 191
planet, 190, 284, 372
atent, 191
the chemist, not dead,
ted, 95
professor of jurispru-
Death of, 95

Knight on roots and
plants,
Lace-net. Patent for
ing,
Lafons's patent,
Lamps. Patent for ce
provements in,
Lampadius on prepari
Land. Patent machin
paring it for the re
seed,
Lane on oxides of iron
Lead. On decomposin
sulphurets by,
Learned Societies, 80,
Levelling land. Machin
Linen cloth. Colour for
Literary and Philosophic
Newcastle,
Literary Society, Manil
Machlachlan on mines
East Indies,
Machnaughtan's patent
Magnetism. On,
Manganese. Colours
has less affinity tha
oxygen, 13; to d
alkaline sulphurets b
Mangle. Patent for,
Manufactures of India.
Margets, George. Life
Medicine, 68
Meller's patent,
Mercury. Experiments
Metal. A new one,
Meteorological tables,
Microscopical remarks,
Milton's patent,
Mines. On the *East In*
Muriate of tin. Decor
of,
Muriates. Production

Muscular motion. On, 113, 217
Museum Alexandrinum, 368

Navigation. Patent respecting, 287
Nickel. To separate, from cobalt, 193; *pure*, a noble metal, 137
Nyren's patent, 95

Oersted's acidulation of sulphate of potash, 80; Galvanic observations, 129

Patents. List of New, 95, 191, 287, 374
Pallas. On the planet, 93, 284, 372
Peel on composition of muriatic acid, potash, and soda, 257
Phosphorus. Action of, on mercury, 60
Polarity communicated by Galvanism, 51
Plants. Prize question respecting, 369, 370
Pollock on a surgical operation on a cow, 308
Potash. Production of, 257
Potatoes, frozen. A query, 286
Prize questions, 184, 368
Publications, New, 282, 360
Pumps. Patent for working, 287
Pyrites applied to production of alum, 65

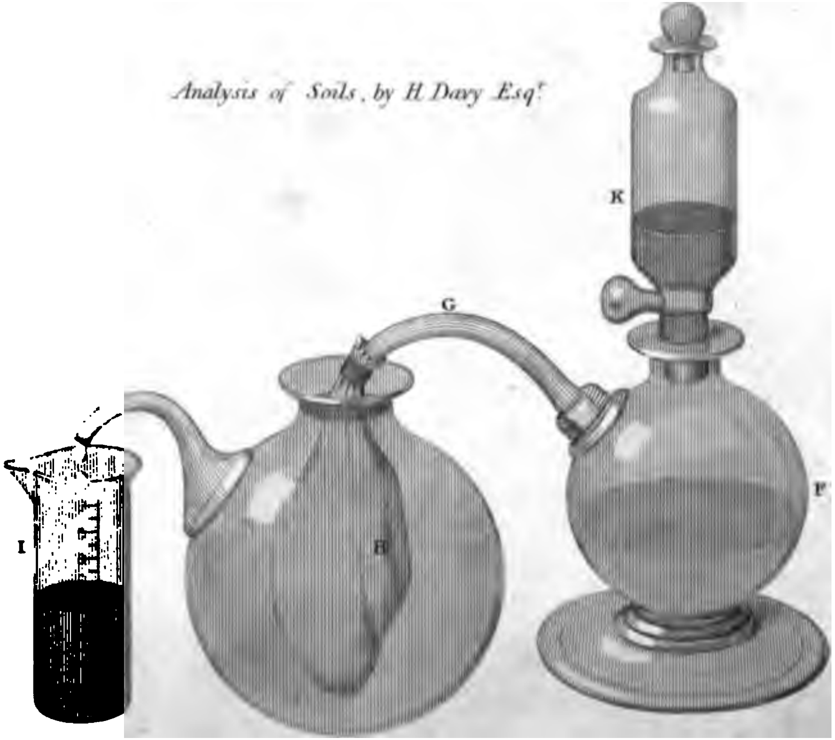
Red. To dye cotton, 228
Richter's process for preparing gallic acid, 74; on pure nickel, 137
Rink on a new acid, 128
Ritter's Galvanic discoveries, 51, 54
Roard on steeping and dyeing wool, 42
Rose on a new vegetable substance, 142
Royal Academy, 272
Royal Institution, 80
Royal Society, 182, 268, 360, 363

Saddle bar. Patent for one on an improved construction, 374
Salt. Its uses as a manure, and a condiment for animals, 16
Saturn. On the singular figure of, 147
Saverein, engineer. Death of, 95
Scrophula. On royal cure of, 271
Shoe-makers. Machine for, 102
Smut of wheat. On, 332
Smutty wheat. On chemical nature of, 346
Snart on a variety of the genus acarus, 3
Societies. Learned, 80, 182, 363
Soda. Production of, 257
Soils. On analysis of, 26
Siqueira-Oliva on mercury, 56
Steam-engine. Patents for, 123, 191, 335
Steel's patent, 287
Stones. On analysing, 146
Stove grate. Patent for, 95
Sugar from beet-root, 14
Sugar. Patent for manufacturing, 287; on history of, 367
Sulphate of potash. Acidulation of, 80
Sulphurets. On decomposing, 70
Sun. On direction and velocity of, 230
Syed's patent, 95

Tables and furniture. Patent, 287
Tannin. Experiments on, 75; on artificial, 173, 320, 365
Taunton on dispensaries, 312
Tea a cure for dropsy, 286
Templeton's remarks on various kinds of timber, 373
Thornton on pneumatic medicine, 68, 212
Tin. Strong affinity of, for oxygen, 12

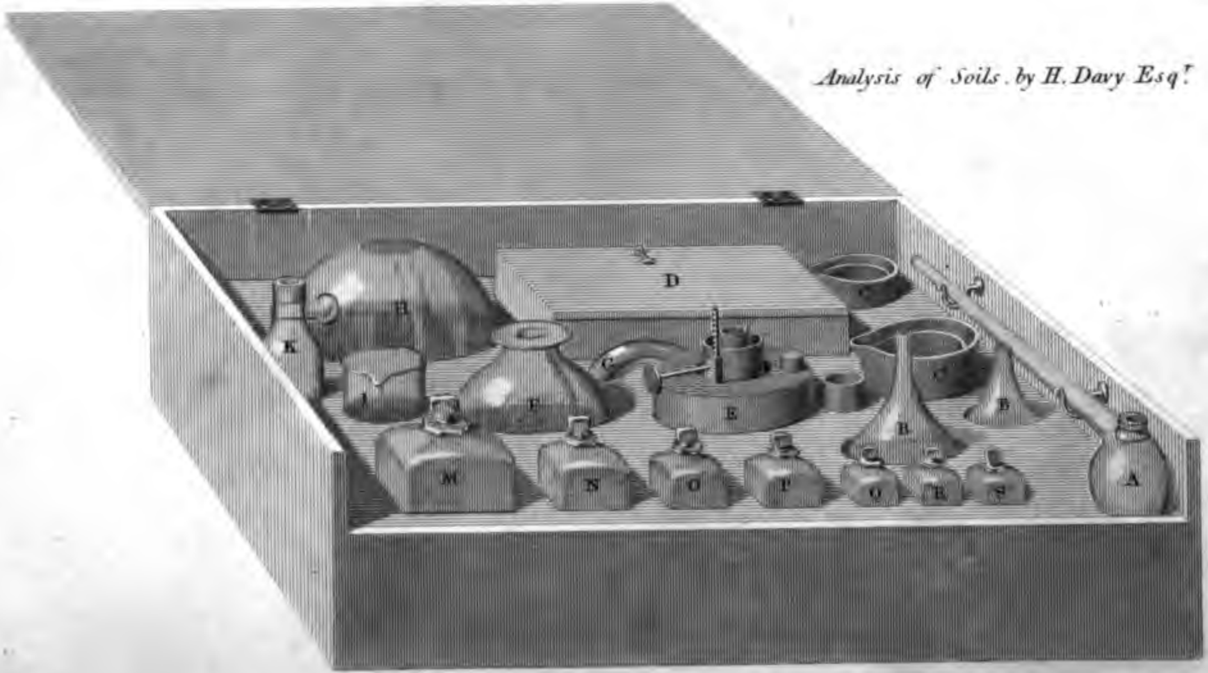
Philo. Mag. Pl. II. Vol. XXIII.

Analysis of Soils, by H. Davy Esq.r



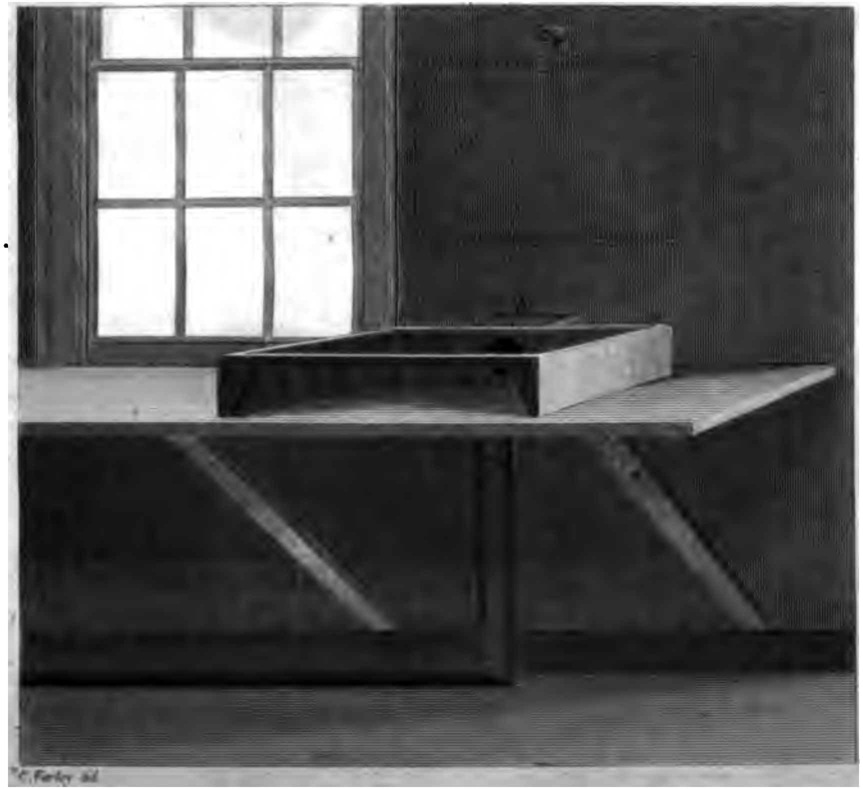
Lowry sculp.

Analysis of Soils. by H. Davy Esq.r

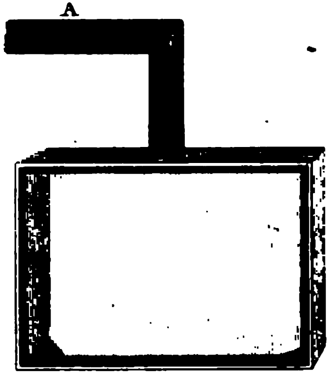


Lowry sculp.

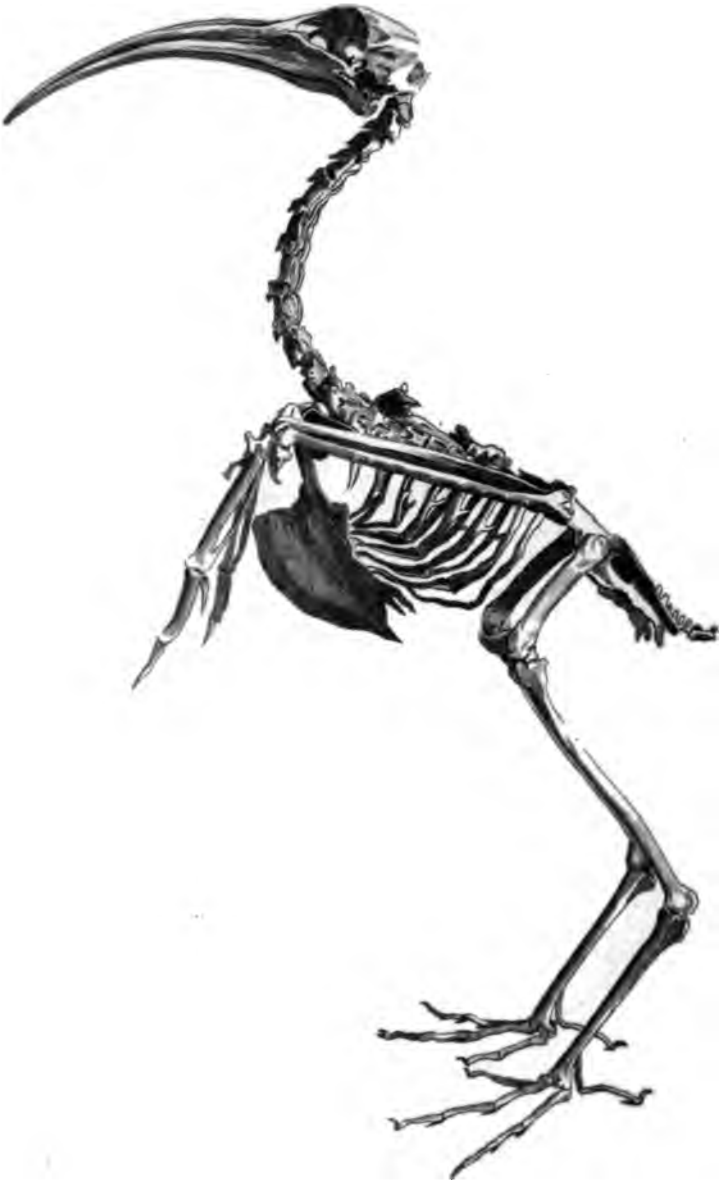
Philo. Mag. Pl. IV. Vol. XXIII.



C. Varley del.



Lowry sculp.

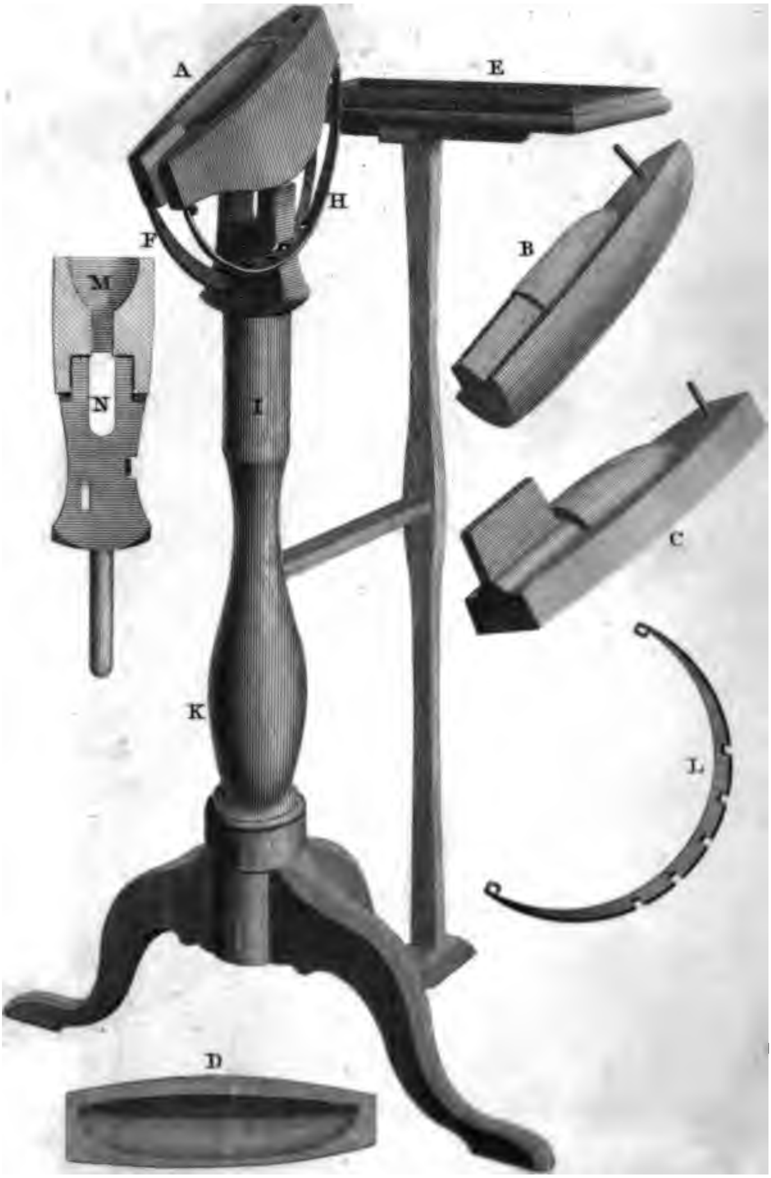


Skeleton of an Ibis, from a Mummy at Thebes.

UNIV. OF MICH.

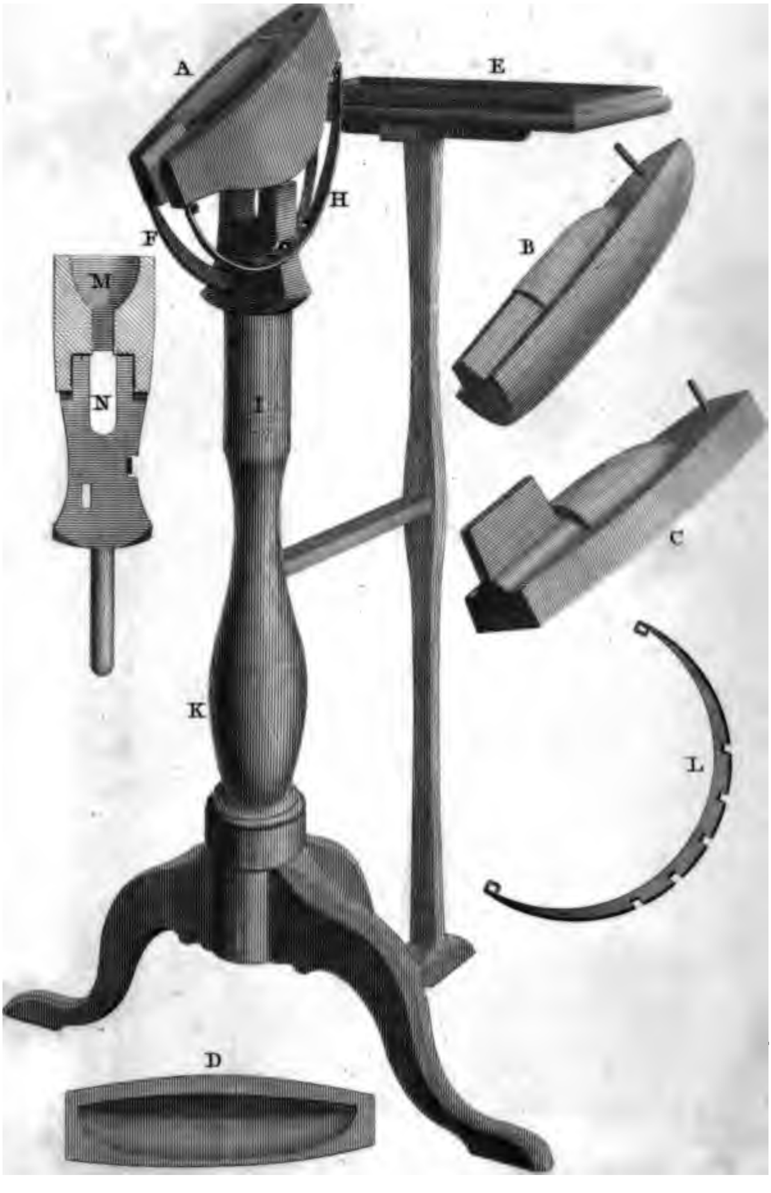
Philo. Mag. Pl. VI. Vol. XXIII.

Mr. Holden's Machine for Shoe makers.



Varley del.

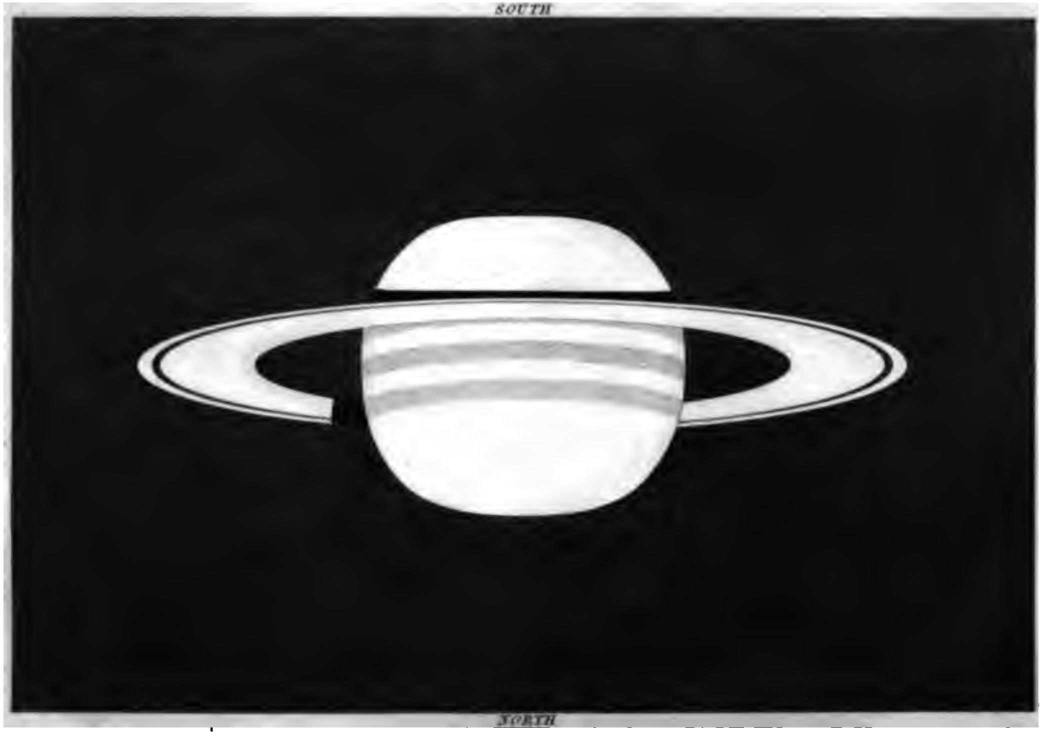
Mr. Holden's Machine for Shoe makers.



C. Varley del.

g2

UNIV. OF M



Engraved by Lowry.

UNIV. OF MICH.
30

Fig. 3.

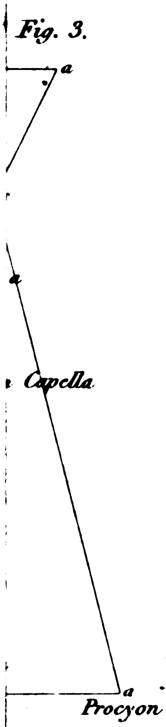
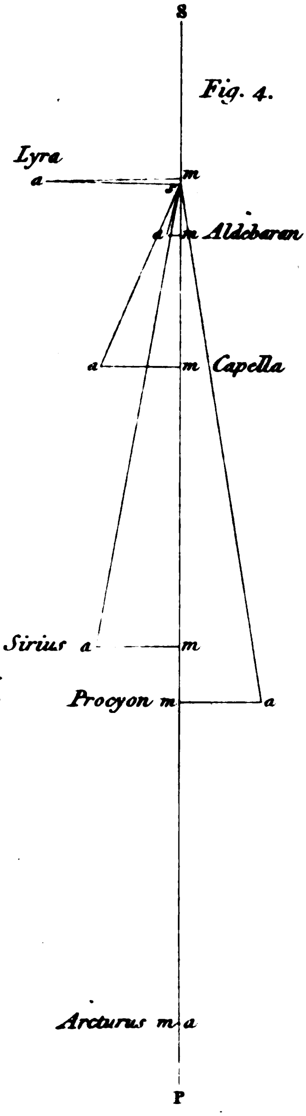


Fig. 4.



Lowry sculp.

Philo. Mag. Pl. IX. Vol. XXIII.

Mr. David Charles's Machine
for laying Land level.

Fig. 2.

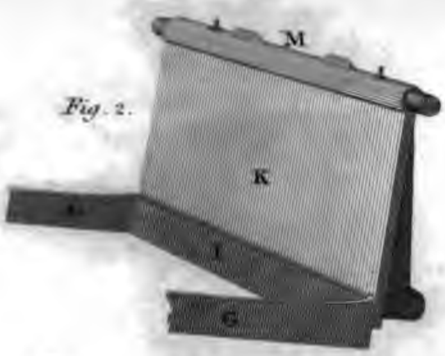
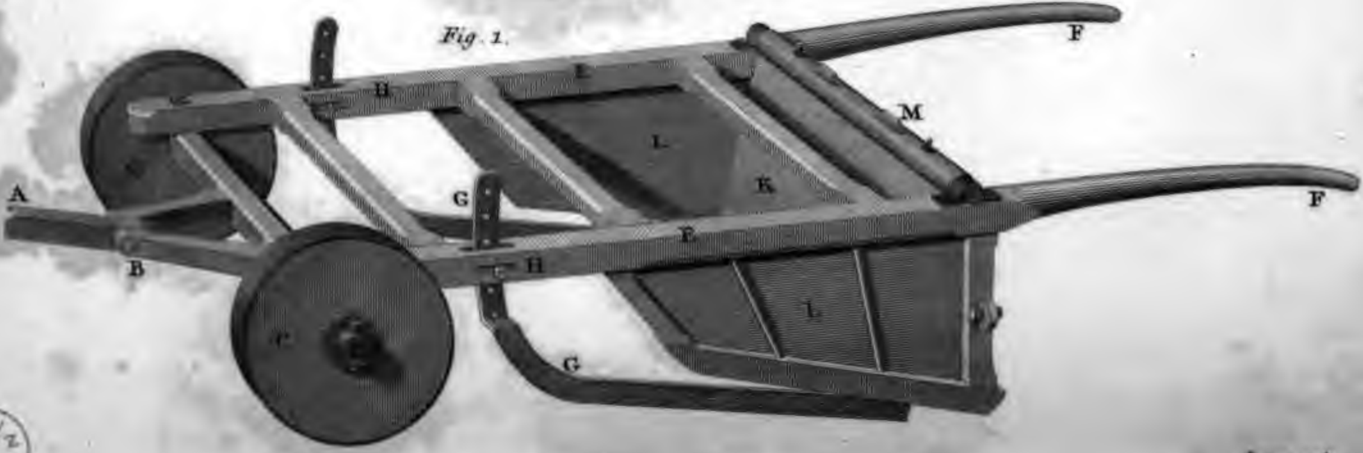


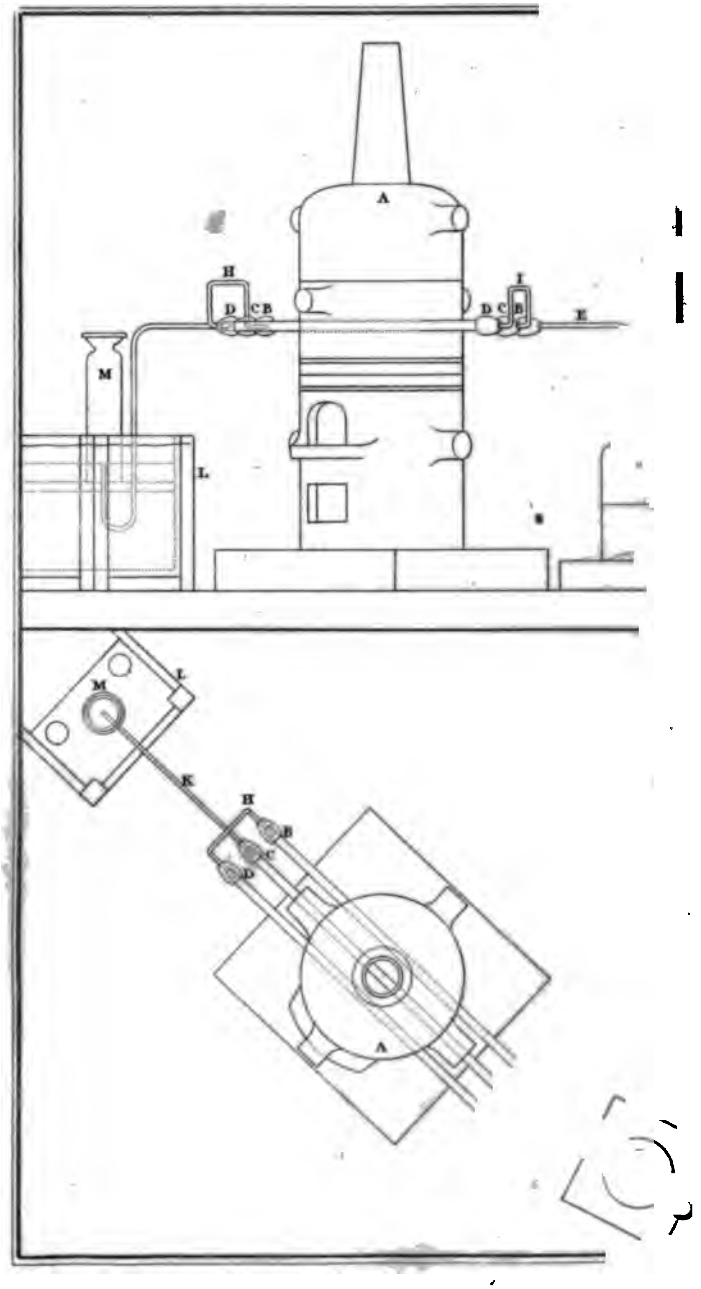
Fig. 1.



Lowry sculp.

UNIV. OF MICH.

Apparatus for preparing Gaseous Oxide of bo



UNIV. OF MICH.

E. Mack

ALEX^{R}. AUBERT ESQ^{R}. F.R.S.

Published by A. Tilloch 1 June 1806.

THE

PHILOSOPHICAL MAGAZINE:

COMPREHENDING
THE VARIOUS BRANCHES OF SCIENCE,
THE LIBERAL AND FINE ARTS,
AGRICULTURE, MANUFACTURES,
AND
COMMERCE.

BY ALEXANDER TILLOCH,
HONORARY MEMBER OF THE ROYAL IRISH ACADEMY, &c. &c. &c.

"Nec aranearum sane textus ideo melior quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes." Just. Lips. *Monit. Polit.* lib. i. cap. 1.

VOL. XXIV.

For FEBRUARY, MARCH, APRIL, and MAY 1806.

LONDON:
Printed by R. Taylor and Co., 38, Shoe Lane, Fleet Street:
And sold by Messrs. Richardson; Cadell and Davies; Longman,
Hurst, Rees, and Orme; Symonds; Murray; Highley;
Vernor and Hood; Harding; London: Bell and
Bradfute, Edinburgh; Brash and Reid, and
D. Nevin, Glasgow; and Gilbert
and Hodges, Dublin.

1806.

5-12-42
45528

CONTENTS

OF THE

TWENTY-FOURTH VOLUME.

I. *ANALYSIS of the Chromate of Iron from the Ouralian Mountains in Siberia. By* A. LAUGIER .. *Page* 3

II. *On the Tendency of Elastic Fluids to Diffusion through each other. By* JOHN DALTON 8

III. *On the Absorption of Gases by Water and other Liquids. By* JOHN DALTON 15

IV. *An Experimental Inquiry into the Nature of Gravelly and Calculous Concretions in the Human Subject; and the Effects of Alkaline and Acid Substances on them, in and out of the Body. By* THOMAS EGAN, *M.D. M.R.I.A.* 25

V. *The Syphon applied to the Worm Tub as a Refrigerator; or, A Plan for conveying Water in any Quantity to a Worm Tub of the largest Dimensions, if perfectly Air tight. By* ALEXANDER JOHNSTON, *Engineer* .. 37

VI. *Description of a Cometarium invented by* EZ. WALKER, *Esq.* 37

VII. *A Description of a Property of Caoutchouc, or Indian Rubber; with some Reflections on the Cause of the Elasticity of this Substance. In a Letter to Dr.* HOLME 39

VIII. *Remarks on Urine, and the Prognostics which are derived from it. By Dr.* COLLENBUCH 44

IX. *Twenty-sixth Communication from Dr.* THORNTON, *relative to Pneumatic Medicine* 47

X. *On a new Black Dye to be applied to all Kinds of Linens and Stuffs. By M.* HERMBSTADT, *of Berlin* .. 49

XI. *New Experiments on the Respiration of Atmospheric*

CONTENTS.

k respect to the Absorption of Azote a
of Gaseous Oxide of Azote. By P
f Kiel .. ..
Experiments and Remarks on an artific
possesses the principal characteristic P
nin. By CHARLES HATCHETT, *E*
.. ..
des of Gold, Tin, and other Metals; w
ding their Uses in Dyeing. Communica
M. BERTHOLLET *by M.* JOHN MICHA
. .. .
tial Fusion of Metals by the Electric D
Correspondent .. ..
oduction of Buds. By THOMAS ANDRE
F.R.S. In a Letter to the Right H
NKS, *K.B. P.R.S.* .. .. ..
of Learned Societies .. .. ..
e and Miscellaneous Articles .. ..
Possibility of naturalizing the Cachem
o the Climate of Europe: in a Letter fr
, of Vienna, to Professor PICTET, *of G*
.. ..
on the Theory of mixed Gases, and t
r in the Atmosphere. By Mr. JO
.. .. 1
ental Inquiry into the Nature of Gravel
Concretions in the Human Subject; and t
line and Acid Substances on them, in a
. By THOMAS EGAN, *M.D. M.R.I.*
1
f a Memoir of Messrs. FOURCROY *a*
pon Guano, the natural Manure of t
nds near the Coast of Peru. Read befo
stitute. Drawn up by A. LAUGIER 1
of Birdlime. By M. BOUILLON-L
.. .. 1
w Varnish for Wood. By M. PARME
. .. . 1
of a Series of Experiments, showing t
Effe

Effects of Compression in modifying the Action of Heat. By Sir JAMES HALL, *Bart. F.R.S. Edin.* 140

XXV. *Additional Experiments and Remarks on an artificial Substance which possesses the principal characteristic Properties of Tannin. By* CHARLES HATCHETT, *Esq. F.R.S.* 155

XXVI. *A simple and accurate Mode of constructing Gasometers for Purposes where uniform Pressure is essential, by the Application of the Hydrostatic Regulator. By* JOSEPH STEEVENS, *Esq.* 163

XXVII. *Process employed to obtain a Black Liquid, invented by Mr.* CLARKE, *an Englishman, and introduced into Commerce; its Use in marking Linen in a solid and durable Manner, and its Application for printing Cottons or Stuffs. By M.* HERMBSTADT, *of Berlin* 165

XXVIII. *Letter of Messrs.* CIONI *and* PETRINI *to Professor* PACCHIANI, *of Pisa, on the supposed Production of Muriatic Acid by Galvanism* 167

XXIX. *On the Decomposition of Water by Galvanism. By* JOHN CUTHBERTSON, *Esq.* 170

XXX. *Notice of Experiments made by the Galvanic Society of Paris on the Discovery announced by M.* PACCHIANI *of the Composition of the Muriatic Acid* 172

XXXI. *Extract of a new Letter of Dr.* FRANCIS PACCHIANI, *Professor of Natural Philosophy in the University of Pisa, to M.* FABRONI, *upon the Composition of the Muriatic Acid* 176

XXXII. *Proceedings of Learned Societies* 180

XXXIII. *Intelligence and Miscellaneous Articles* .. 188

XXXIV. *Account of a Series of Experiments, showing the Effects of Compression in modifying the Action of Heat. By Sir* JAMES HALL, *Bart. F.R.S. Edin.* .. 193

XXXV. *A new Fact in Galvanism. Communicated by a Correspondent* 203

XXXVI. *On Vaccination. An Examination of several of the Mis-statements of Dr.* ROWLEY. *By Mr.* J. J. HAWKINS, *of Islington* 204

XXXVII. *On the Method of extracting Spirits from Potatoes.*

. GERMAIN, *Chemist to the Military*
.. ..
s of destroying the Insects and Caterpil
ruit Trees. By Madame GAÇON DU
ments upon the Gaseous Oxide of A
ting of Amateurs, of Toulouse. Descr
, Professor of Chemistry in the Instit
.. ..
Cases in the Finsbury Dispensary, f
uary to the 31*st of March* 1806.
N, *Esq. Surgeon to the City and F*
ies, and Lecturer on Anatomy, Physiol
.. ..
idation of Metals in general, and part
ation of Iron. Read in the French Natio
. THENARD .. ..
Combination of Antimony with Tin.
.. ..
ent of certain Papers written on the ap
e of the horizontal Moon, and published
To which are added, new Experiment
h of the Author's Theory, and to exhib
ation of the Phænomenon on optical Pr
. WALKER, *Esq.* 2
of a Letter from M. LEOPOLD DE BUC
Professor PICTET, *of Geneva, on the P*
iatic Acid and Soda by the Galvanic
Water 2
eventh Communication from Dr. THOR
o Pneumatic Medicine 2
eighth Communication on Pneumatic Me
Dr. THORNTON, *from Mr.* HILL, *Surg*
2
Electrogene of SCHMIDT. *By Count* STER
resident of the Electoral Regency of R
.. .. 2
of M. ORSTED, *Professor of Philosophy,*
Copenhage

Copenhagen, to Professor PICTET *of Geneva, upon Sonorous Vibrations* 251
XLIX. *On the Use of the Sutures in the Skulls of Animals. By Mr.* B. GIBSON 256
L. *On the Existence of Phosphate of Magnesia in Bones. By* M. FOURCROY 262
LI. *Notices respecting New Books* 265
LII. *Proceedings of Learned Societies* 271
LIII. *Intelligence and Miscellaneous Articles* 282
LIV. *On Transit Instruments. By* EZ. WALKER, *Esq.* 289
LV. *Account of a Series of Experiments, showing the Effects of Compression in modifying the Action of Heat, By Sir* JAMES HALL, *Bart. F.R.S. Edin.* .. 291
LVI. *Observations and Advices respecting Improvements compatible with the quickest. Manufacture of Muscovado Sugar, and conducive to the Melioration of the Rum. By* BRYAN HIGGINS, *M.D.* 308
LVII. *Letter of M.* TARDY DE LA BROSSY *to Professor* PICTET, *of Geneva, upon the Experiments of Mr.* BIDDLE, *relative to the Density of frozen Mercury* .. 322
LVIII. *Analysis of the sulphuretted Oxide of Manganese of Naygag. By M.* VAUQUELIN 324
LIX. *Memoir on the Eremophilus and Astroblepus, two new Genera of the Order of Apodes. By M.* DE HUMBOLDT 329
LX. *Memoir on a new Species of Pimelodus thrown out of the Volcanoes in the Kingdom of Quito; with some Particulars respecting the Volcanoes of the Andes. By M.* DE HUMBOLDT 333
LXI. *Memoir on a new Species of Monkey, found in the eastern Declivity of the Andes. By M.* DE HUMBOLDT 339
LXII. *Analysis of the Hot Springs at Bath. By Mr.* RICHARD PHILLIPS, *Member of the Askesian and of the British Mineralogical Societies* 342
LXIII. *Proceedings of Learned Societies* 361
LXIV. *Intelligence and Miscellaneous Articles* .. 366

IV. OF MI

lar, and not granulated; its metallic b
vivid, and it evidently contains a smal
rthy matters. The specimen in my p
pots of green on some parts of its surfa
overed to be oxide of chrome. The s
he two also serves to support my conject
That of my specimen is 4·0579, w
ity of the mineral of Var is only 4·03
n weight necessarily makes a difference
of the metallic part of the two chroma
ll presently see, the analysis agrees c
physical property.

Chemical Examination.

ngly calcined it loses about 1-100th par
acquires a reddish brown colour. Ha
of this mineral reducéd to an impalp
r with 300 parts of pure potash, in a cr
exposed the whole to a strong heat.
noved from the fire, and nearly cooled,
en and in part of an orange colour.
dded to it assumed a rich citron yell
the colour of chromate of potash. W
er gave a tinge to distilled water, I dige
muriatic acid, with the intention of s
of the oxide of iron had been set fre
potash, without touching, in any deg
f iron, which was still undecomposed
remaining substance again, till the v
and a second time melted it with a po

heated the mineral six different times,
potash and muriatic acid; setting asid
d solutions, that I might examine then

n consisted of a brownish gray ma
muriatic acid took up from it a little
er was completely dissolved in nitro-mu

acid. This solution which was of a reddish brown colour, let fall a yellow precipitate on the addition of muriate of ammonia, and a deep red precipitate by the muriate of tin at the minimum of oxidation: it suffered no precipitation by prussiate of potash, and formed with soda a triple salt of a beautiful red colour. It was therefore no other than a portion of platina which had been separated from the crucible by the six successive manipulations; and there was every reason to believe that the alkali and acid had completely dissolved the constituent ingredients of the mineral in question.

Examination of the Alkaline Solution.

2. This solution had a very beautiful deep yellow colour. The last portions of the solution had a greenish tinge, which disappeared on the spontaneous deposition of a brown substance in small quantity, which I discovered to be oxide of manganese. I poured, by degrees, into the solution, evaporated to one-half its former bulk, such a quantity of nitric acid as saturated the caustic portion of alkali; and a precipitate fell to the bottom, which I collected upon a filter, then washed it, and submitted it to calcination. It weighed 11 hundredth parts, and was set aside for future examination.

The addition of a slight excess of nitric acid produced no precipitation but merely a violent effervescence, and caused the solution to assume a very deep orange red colour. When evaporated to dryness it left a saline residuum of a fine yellow colour, which dissolved completely in water: the solution, when acidulated with nitric acid, furnished by the nitrate of mercury a red precipitate, which after being dried in the air weighed 430 parts; and these by calcination were reduced to 52 hundredth parts of an oxide of chrome, having a beautiful green colour.

3. The matter precipitated in No. 2 by the nitric acid was melted with three parts of caustic potash; and the mass, when mixed with water, dissolved completely in muriatic acid. The solution, when evaporated to dryness,

nalysis of the Chromate of Iron

part of which was insoluble in water, a
lcination, only one-half part: it consis
lica and oxide of iron. I now poured i
contained the soluble portion of the m
y of ammonia; and a white flocculent p
which formed with the water a jelly,
characters of alumine: it weighed 10 h
a half.

periments on the alkaline solution we m
contained chrome, alumine, a little o
together with some particles of iron

nation of the Muriatic Solution.

of this solution, which contained an ex
lish yellow. On the addition of a solu
a flocculent matter of a brownish red
when washed and mixed with the s
e of iron already obtained, both from
and from the residue, discovered to be
fter being calcined, 34 hundredth parts
ontinued still coloured after the separa
iron, although the re-agents indicated
hrome: I was therefore couvinced tha
a small quantity of platina. The ex
which I had added contained some
, and these I separated by means of
-

w to ascertain the purity of the oxid
the usual colour and appearance of
again with pure potash: but water, w
xture, received no tinge, and the re-ag
sence of no foreign substance. We m
hat the very weak muriatic acid whi
lved nothing but the oxide of iron.

F

From the above analysis it appears that the chromate of iron of Siberia contains in the 100 parts,

Oxide of chrome -	53
Oxide of iron - -	34
Alumine - - -	11
Silica - - -	1
	99
Traces of manganese and loss	1
	100

These results are nearly similar to what M. Vauquelin obtained from the chromate of Var.

Chromic acid - -	43
Oxide of iron - -	34·7
Alumine - - -	20·3
Silica - - -	2
	100

Does the chrome exist in the state of acid or in that of oxide in the mineral termed chromate of iron? M. Godon de Saint-Mesmin, in a memoir upon the combinations of chromic acid, read at the National Institute, has discussed this question, and is inclined to think that it is in the state of oxide. M. Vauquelin, in his report of this memoir, seems disposed to adopt the same opinion. I shall merely state, in support of this idea, an experiment which renders it probable. If the green oxide of chrome be gently calcined with pure potash, it is almost immediately brought to the state of an acid: we are therefore not warranted in asserting that chrome exists as an acid in the chromate of iron, while by the presence of potash this conversion of the oxide is rendered likely. It is then, at least, highly probable that the mineral which till now has received the name of chromate of iron, is, in fact, no other than a combination of the oxides of iron and chrome.

Since I finished my examination of the chromate of iron

re learnt that M. Lowitz has also analys
I am ignorant of the exact proportions
according to his experiments, but if I m
note relative to this subject which appear
Physique, his results were nearly the sa
he announces that he found it to conta
its weight of oxide of chrome, togeth
ine, and a little silica.

ency of *Elastic Fluids to Diffusion throu*
other. *By* John Dalton*.

riod of pneumatic chemistry it was dis
c fluids of different specific gravities be
ough each other, do not of themselves
tanding, in such manner as that the h
n the lowest place; but, on the contr
of uniform and equal diffusion.

has given us a section on this subject (
Observations, &c. abridged, vol. ii. p.4
s proved the fact above mentioned in a
er; and every one's experience since,
has coincided with his conclusions.

ny conjecture concerning the cause of
he law observed by inelastic fluids; bu
if two kinds of air of very different spe
it into the same vessel, with very great
st agitation that might mix or blend t
night continue separate, as with the s
ater may be made to do."

ation of this point, which seems at
ial one, is of considerable importance
obtain a striking trait, either of the a
ement of elastic and inelastic fluids in
n each other.

the subject of the following experin
ther two elastic fluids, brought into co

Manchester Transactions, second series, vol. I.

could intermix with each other independently of agitation. The result seems to give it in the affirmative beyond a doubt, contrary to the suggestion of Dr. Priestley, and establishes this remarkable fact, that a lighter elastic fluid cannot rest upon a heavier, as is the case with liquids; but they are constantly active in diffusing themselves through each other till an equilibrium is effected, and that without any regard to their specific gravity, except so far as it accelerates or retards the effect, according to circumstances.

The only apparatus found necessary was a few phials, and tubes with perforated corks: the tube mostly used was one 10 inches long, and of 1-20th of an inch bore; in some cases a tube of 30 inches in length and 1-3d inch bore was used: the phials held the gases that were subjects of experiment, and the tube formed the connection. In all cases the heavier gas was in the under phial, and the two were placed in a perpendicular position, and suffered to remain so during the experiment in a state of rest: thus circumstanced, it is evident that the effect of agitation was sufficiently guarded against; for, a tube almost capillary, and ten inches long, could not be instrumental in propagating an intermixture from a momentary commotion at the commencement of each experiment.

FIRST CLASS.

Carbonic Acid Gas, with Atmospheric Air, Hydrogenous, Azotic, and Nitrous Gases.

1. A pint phial filled with carbonic acid gas, the 30 inch tube and an ounce phial, the tube and small phial being filled with common air, were used at first. In one hour the small phial was removed, and had acquired no sensible quantity of acid gas, as appeared from agitating lime water in it. In three hours it had the acid gas in great plenty, instantly making lime water milky. After this it was repeatedly removed in the space of half an hour, and never failed to exhibit signs of the acid gas. Things remaining just the same, the upper phial was filled with the different gases mentioned above repeatedly, and in half an hour there was always found acid sufficient to make the phial,

one-ha

ith lime water, quite milky. There w
ible difference, whatever gas was in t

SECOND CLASS.

s, with Atmospheric Air and Oxygen Gas.

nce phials were connected by the tube
ree inches long, the upper containing h
the lower atmospheric air: after standi
wer phial was examined; the mixed ga
e six explosions in a small phial. The
exploded.

unce phials connected with the ten-in
two days, having common air and hyd
examination the upper was found to
n air by the test of nitrous gas. The
ploded smartly; that in the upper mo
bent flame.

ance phials were connected by the ten-i
common air and hydrogenous gas:
a half the upper was about one-third co
e under two-thirds; the former explo
smartly.

unce phials were connected as above;
gas about three-fourths oxygenous,
us: in three hours the latter was one-f
he former about one-half; the upper
the under moderately.

ounce phials were again connected,
ospheric air, the upper hydrogenous g
n hours, and were then examined:
with nitrous gas, the under 1·66. He
t an equilibrium had taken place, or
uniformly diffused through each othe

---

of ten inches was then used, and a phial of com
h acid gas had come through, as appeared by

TH

THIRD CLASS.

Nitrous Gas, with Oxygenous Gas, Atmospheric Air, Hydrogenous and Azotic Gases.

The results of the preceding experiments upon gases that have no known affinity for each other, were conformable to what, *à priori*, I had conceived; for, according to my hypothesis, every gas diffuses itself equably through any given space that may be assigned to it; and no other gas being in its way can prevent, though it may considerably retard, this diffusion. But in some of the following experiments, in which the two gases are known to have a chemical affinity for each other, I expected different results from what were found; perhaps without sufficient reason. For chemical union cannot take place till the particles are brought into contiguity; and the elastic force which sets them in motion appears, from the above experiments, to be a principle diametrically opposite to affinity. That circulation of elastic fluids, therefore, which we have now before us, cannot be accelerated by their having a chemical affinity for each other. Another circumstance deserves explanation: when nitrous and oxygenous gas are in the two phials, the residuary gases after the experiment are nearly as pure as before; because those portions of them that meet in the tube form nitrous acid vapour, which is absorbed by the moisture in the phials, and therefore does not contaminate either gas.

1. Two one-ounce phials were connected with the small tube, the under containing nitrous gas, the upper atmospheric air. After three hours the upper phial was taken off, when a quantity of air was perceived to enter, as was expected: the air in the upper phial was scarcely distinguishable from what it was at first; that in the under phial was still so much nitrous as to require its own bulk of common air to saturate it.

2. The above experiment was repeated, and the upper phial drawn off when the whole was under water, in order to prevent communication with the atmosphere. About one-sixth of an ounce of water entered the phials, to compensate

ition. Remaining air in the upper phi
vorse than common air; it being of th
ien the former was 1·44. The gas in th
ill nitrous, and nearly of the same purit
ee parts of it required four of atmospher
n.

and one two-thirds oxygenous were trie
After four hours the apparatus was take
The upper phial was two-thirds fille
he gas in it was partly driven down th
phial, by which, and the previous pro
gas was completely saturated, and nothin
small portion of oxygenous, were four
The remaining gas in the upper phi
oxygenous.

and hydrogenous. In three hours th
e-fourth nitrous, and of course the und
art of hydrogen.

and azotic. After three hours the upp
nitrous.

experiments the quantity of nitrous g
l was less than might be expected; b
t filled with common air, and some mi
ng the apparatus, which is sufficient
sults.

FOURTH CLASS.

h Mixtures containing Oxygenous Gas.

and one two-thirds oxygenous. Af
urs the upper phial was of the standa
-fourteenth oxygenous.

with atmospheric air. After standi
per phial was not sensibly diminished
under phial, however, had lost two
of its oxygen. The reason of this w
s in this experiment, having been j
nitrous gas, this last had not been co
th atmospheric air, and hence had sei
n ascending into the upper phial.

Hav

Having now related all the experiments I made of any importance to the subject, it will be proper to add, for the sake of those that may wish to repeat some of them, that great care must be taken to keep the inside of the tube dry; for if a drop of water interpose between the two gases, I have found that it effectually prevents the intercourse. Glass tubes should therefore be used, that one may be satisfied on this head, as the obstruction will then be visible.

I shall make no further comments on the above experiments by way of explanation; because, to those who understand my hypothesis of elastic fluids, they need none: and I think it would be in vain to attempt an explanation any other way. I cannot however, on this occasion, avoid adverting to some experiments of Dr. Priestley, which few modern philosophers can be unacquainted with: I mean those relating to the seeming conversion of water into air. (*Vide* Philos. Transact. vol. lxxiii. p. 414; or his Experiments abridged, vol. ii. p. 407.) He found that unglazed earthen retorts, containing a little moisture, when heated, admitted the external air to pass through their pores at the same time that aqueous vapour passed through the pores the contrary way, or outward; and that this last circumstance was necessary to the air's entrance. The retorts are air-tight, so far as that blowing into them discovers no pores; but when subjected to a greater pressure, as that of the atmosphere, or even one much short of it, they are not able to prevent the passage of elastic fluids. The fact of air passing into the retort through its pores, and vapour out of them at the same time, are elegantly and most convincingly shown by Dr. Priestley's experiments, in which he used the apparatus represented in Plate VII. fig. 1. of the edition above referred to. The doctor confesses his explanation of these remarkable facts is very inadequate; and no wonder, for it is impossible for him or any other to explain them on the commonly received principles of elastic fluids. But we will hear what he says on the subject:—" At present it is my opinion that the agent in this case is that principle which we call attraction of cohesion, or that power by which water is raised in capillary tubes. But in what manner it acts in this

far from being able to explain. Much l
ow air should pass one way and vapour
ne pores, and how the transmission of
necessary to the transmission of the otl
owever, that it is by means of such pc
orced through, that this curious proces
use the experiment never succeeds but
, by the air-pump at least, appear to
n all such."
these facts, so difficult to explain, are
hose which are the subject of this mem
a great number of pores, we have on
de—the bore of the tube. Let the por
same elastic fluid within and without,
d the two phials contain the same ela
er, then no transmission is observable
he retort have common air, or any o
nd aqueous vapour, or any other ela
outside one, within; then the motio
ces, just as with the phials in similar
fact, this last observation has since b
Priestley himself, of which an accoun
of the American Philosophical Tran
After alluding to his experiments at
serves: "Since that time I have exten
he experiments, and have observed,
y air and water will be done by any
whether they have affinity to one ano
takes place in circumstances of whi
pprised before, and such as experimen
ainted with, in order to prevent mist
onsequence."
ed above, taken altogether, appear to
ve evidence for that theory of elastic fl
, and against the one commonly recei
principle which has ever been deem
e can adduce.

III. *On the Absorption of Gases by Water and other Liquids.*

By John Dalton[*].

1. If a quantity of pure water be boiled rapidly for a short time in a vessel with a narrow aperture, or if it be subjected to the air-pump, the air exhausted from the receiver containing the water, and then be briskly agitated for some time, very nearly the whole of any gas the water may contain will be extricated from it.

2. If a quantity of water thus freed from air be agitated in any kind of gas not chemically uniting with water, it will absorb its bulk of the gas, or otherwise a part of it equal to some one of the following fractions, namely, $\frac{1}{8}$, $\frac{1}{27}$, $\frac{1}{64}$, $\frac{1}{125}$, &c., these being the cubes of the reciprocals of the natural numbers 1, 2, 3, &c., or $\frac{1}{1^3}$, $\frac{1}{2^3}$, $\frac{1}{3^3}$, $\frac{1}{4^3}$, &c., the same gas always being absorbed in the same proportion, as exhibited in the following table. It must be understood that the quantity of gas is to be measured at the pressure and temperature with which the impregnation is effected.

Bulk absorbed, the bulk of water being unity.	
$\frac{1}{1^3} = 1$	Carbonic acid gas, sulphuretted hydrogen, nitrous oxide[†].
$\frac{1}{2^3} = \frac{1}{8}$	Olefiant gas of the Dutch chemists.
$\frac{1}{3^3} = \frac{1}{27}$	Oxygenous gas, nitrous gas[‡], carburetted hydrogen gas, from stagnant water.
$\frac{1}{4^3} = \frac{1}{64}$	Azotic gas, hydrogenous gas, carbonic oxide.
$\frac{1}{5^3} = \frac{1}{125}$	None discovered.

---

[*] From *Manchester Transactions*, second series, vol. i.

[†] According to Mr. William Henry's experiments, water does not imbibe quite its bulk of nitrous oxide: in one or two instances with me it has come very near it. The apparent deviation of this gas may be owing to the difficulty of ascertaining the exact degree of its impurity.

[‡] About 1-26th of nitrous gas is usually absorbed, and 1-27th is recovera-

3. The

thus absorbed may be recovered from
e in quantity and quality as it entered,
ted out in the first article.

tity of water free from air be agitated wi
or more gases (such as atmospheric air),
orb portions of each gas the same as if
to it separately in their proper density.

nospheric air, consisting of 79 parts az
ts oxygenous gas, per cent.

sorbs $\frac{1}{64}$ of $\frac{79}{100}$, azotic gas = 1·234
——— $\frac{1}{27}$ of $\frac{21}{100}$, oxygen gas = ·778

Sum, per cent. 2·012

impregnated with any one gas (as hy
tated with another gas equally absorbable
vill apparently be no absorption of the l
uch gas being found after agitation as
the water; but upon examination the
e found a mixture of the two, and the
water, will be exactly proportional to t
r.

impregnated with any one gas be agi
as less or more absorbable, there will a
rease or diminution of the latter; but
e residuary gas will be found a mixtu
e proportions agreeable to article 4.

tity of water in a phial, having a gr
curately adapted, be agitated with any
gases, till the due share has entered th
e stopper be secured, the phial may b
variation of temperature without distu
: that is, the quantity of gas in the
same whether it be exposed to heat or
e air-tight.

---

is owing to the residuum of oxygen in the wate
kes 3½ of nitrous gas to saturate it when in water
d that nitrous gas usually contains a small portio

N. B. The phial ought not to be near full of water, and the temperature should be between 32° and 212°.

8. If water be impregnated with one gas (as oxygenous, and another gas, having an affinity for the former (as nitrous), be agitated along with it, the absorption of the latter gas will be greater, by the quantity necessary to saturate the former, than it would have been if the water had been free from gas *.

9. Most liquids free from viscidity, such as acids, alcohol, liquid sulphurets, and saline solutions in water, absorb the same quantity of gases as pure water, except they have an affinity for the gas, such as the sulphurets for oxygen, &c.

The preceding articles contain the principal facts necessary to establish the theory of absorption; those that follow are of a subordinate nature, and partly deducible as corollaries to them.

10. Pure distilled water, rain and spring water, usually contain nearly their due share of atmospheric air; if not, they quickly acquire that share by agitation in it, and lose any other gas they may be impregnated with. It is remarkable, however, that water by stagnation, in certain circumstances, loses part or all of its oxygen, notwithstanding its constant exposition to the atmosphere. This I have uniformly found to be the case in my large wooden pneumatic trough, containing about eight gallons, or 1¼ cubic foot of water. Whenever this is replenished with tolerably pure rain water, it contains its share of atmospheric air, but in process of time it becomes deficient of oxygen: in three months the whole surface has been covered with a pellicle, and no oxygenous gas whatever was found in the water. It was grown offensive, but not extremely so; it had not been contaminated with any material portion of metallic

---

* One part of oxygenous gas requires 3·4 of nitrous gas to saturate it in water. It is agreeable to this that the rapid mixture of oxygenous and nitrous gas over a broad surface of water occasions a greater diminution than otherwise. In fact, the nitrous acid is formed this way; whereas when water is not present the nitric acid is formed, which requires just half the quantity of nitrous gas, as I have lately ascertained.

sulphureous mixtures, or any other arti
ect could be ascribed*. The quantity of
naterially diminished by stagnation, if
nstances, not being duly noticed, have
f great diversity in the results of differen
on the quantity and quality of atmosphe
By article 4, it appears that atmospher
n water ought to have 38 per cent. ox
his article air may be expelled from wat
from 38 to 0 per cent. of oxygen. Th
f oxygenous gas in water, I presume, m
ne impurities in the water which combin
Pure rain water that had stood more
rthen-ware bottle had lost none of its oxy
ter free from air be agitated with a
nospheric air (as 1-15th of its bulk), th
h air will have proportionally less oxyge
if we take 1-15th, as above, then th
ave only 17 per cent. oxygen, agreeably
blished in article 4. This circumstan
he observations made by Dr. Priestle
Henry, that water absorbs oxygen i
te.

ll glass vessel, containing a small por
ted into a deep trough of water, and
by the glass and the water be briskly a
lly disappear.

nder that Dr. Priestley, who seems t
to notice this fact, should have ma
: the loss of gas has evidently a mec
itation divides the air into an infinite
bbles, which may be seen pervading th
are successively driven out from un
glass into the trough, and so escape.

stagnant water be in the trough in t
nd atmospheric air be the subject, t
ill very soon be almost wholly extract
um of azotic gas; but if the water

---

* It was drawn from a leaden cistern.

impr

impregnated with atmospheric air at the beginning, the residuary gas, examined at any time, will be pure atmospheric air.

14. If any gas, not containing either azotic or oxygenous gas, be agitated over water containing atmospheric air, the residuum will be found to contain both azotic and oxygenous gas.

15. Let a quantity of water contain equal portions of any two or more unequally absorbable gases; for instance, azotic gas, oxygenous gas, and carbonic acid gas; then let the water be boiled, or subjected to the air pump, and it will be found that unequal portions of the gases will be expelled: the azotic will be the greatest part, the oxygenous next, and the carbonic acid will be the least. For, the previous impregnation being such as is due to atmospheres of the following relative forces nearly,

Azotic - -	21	inches of mercury
Oxygenous -	9	ditto
Carbonic acid	0⅓	ditto

consequently, when those forces are removed, the resiliency of the azotic gas will be the greatest, and that of the carbonic acid the least; the last will even be so small as not to overcome the cohesion of the water without violent agitation.

Remarks on the Authority of the preceding Facts.

In order to give the chain of facts as distinct as possible, I have not mentioned by whom, or in what manner, they were ascertained.

The fact mentioned in the first article has been long known; a doubt, however, remained respecting the quantity of air still left in water after ebullition and the operation of the air pump. The subsequent articles will, I apprehend, have placed this in a clearer point of view.

In determining the quantity of gases absorbed, I had the result of Mr. William Henry's experience on the subject before me, an account of which has been published in the Philosophical Transactions for 1803. By the reciprocal communications since, we have been enabled to bring the

ır experiments to a near agreement, as th
ıs given in his appendix to that paper ne
hose I have stated in the second article.
s with the less absorbable gases, or thos
4th classes, I used a phial holding 270
aving a very accurately ground stopper;
ore absorbable of the first class I used an
properly graduated, and of aperture so
h the end of a finger. This was filled w
small portion expelled by introducing
r water: the quantity being noticed
f water that entered on withdrawing th
finger was applied to the end, and th
tated: then, removing the finger for
r water, an additional quantity of water
itation was repeated till no more water
n the quantity and quality of the resid
ned. In fact, water could never be made
any gas by this procedure; but if it took 9
r part, and the residuary gas was 9-10th
inferred that water would take its bulk
principle was the same in using the phia
ntity of the gas was admitted, and the a

e two very important facts contained in
. The first is, that the quantity of gas a
nsity or pressure. This was discovered
enry, before either he or I had formed an
ect.

r is, that the density of the gas in the w
ation to that out of the water, the dis
es within being always some multiple
Thus, in the case of carbonic acid, &c
in and without is the same, or the g
of the same density as without; in ol
of the particles in the water is twice th
ygenous gas, &c. the distance is just th
ithin as without; and in azotic, &c.
is fact was the result of my own inqui

former of these, I think, decides the effect to be mechanical; and the latter seems to point to the principle on which the equilibrium is adjusted.

The facts noticed in the 4th, 5th, and 6th articles were investigated, *à priori*, from the mechanical hypothesis, and the notion of the distinct agency of elastic fluids when mixed together. The results were found entirely to agree with both, or as nearly as could be expected from experiments of such nature.

The facts mentioned in the 7th article are of great importance in a theoretic view; for, if the quantity of gas absorbed depend upon mechanical principles, it cannot be affected by temperature in confined air, as the mechanical effect of the external and internal air is alike increased by heat, and the density not at all affected in those circumstances. I have tried the experiments in a considerable variety of temperature without perceiving any deviation from the principle. It deserves further attention.

If water be, as pointed out by this essay, a mere receptacle of gases, it cannot affect their affinities: hence what is observed in the 8th article is too obvious to need explanation. And if we find the absorption of gases to arise not from a chemical but a mechanical cause, it may be expected that all liquids having an equal fluidity with water will absorb like portions of gas. In several liquids I have tried, no perceptible difference has been found; but this deserves further investigation.

After what has been observed, it seems unnecessary to add any explanation of the 10th and following articles.

Theory of the Absorption of Gases by Water, &c.

From the facts developed in the preceding articles, the following theory of the absorption of gases by water seems deducible:

1. All gases that enter into water and other liquids by means of pressure, and are wholly disengaged again by the removal of that pressure, are mechanically mixed with the liquid, and not chemically combined with it.

2. Gases so mixed with water, &c. retain their elasticity

e power amongst their own particles, just
er as out of it, the intervening water h
ence in this respect than a mere vacuum.
gas is retained in water by the pressure of
incumbent on its surface abstractedly co
as with which it may be mixed having
fluence in this respect.

n water has absorbed its bulk of carb
he gas does not press on the water at
the containing vessel just as if no water
er has absorbed its proper quantity of ox
at is, $\frac{1}{27}$ of its bulk, the exterior gas p
of the water with $\frac{26}{27}$ of its force, and o
with $\frac{1}{27}$ of its force, which force presses
vessel and not on the water. With a
us gas the proportions are $\frac{63}{64}$ and $\frac{1}{64}$ res
er contains no gas, its surface must su
sure of any gas admitted to it, till the ga
d its way into the water.

rticle of gas pressing on the surface of
to a single shot pressing upon the sum
of them. As the shot distributes its
ongst all the individuals forming the lo
pile, so the particle of gas distributes its
ongst every successive horizontal stratu
ter downwards till it reaches the sphere
other particle of gas. For instance, le
a given force on the surface of water, a
the particles of gas from each other b
10 to 1; then each particle of gas m
ually amongst 100 particles of water, as f
immediate force upon 4 particles of wa
n 9, the 9 upon 16, and so on accord
are numbers, till 100 particles of wate
buted amongst them; and in the sam
of 100, having its incumbent particle
w this stratum is uniformly pressed
quently has not its equilibrium distur

When water has absorbed $\frac{1}{27}$ of its bulk of any gas, the stratum of gas on the surface of the water presses with $\frac{26}{27}$ of its force on the water, in the manner pointed out in the last article, and with $\frac{1}{27}$ of its force on the uppermost stratum of gas in the water: the distance of the two strata of gas must be nearly 27 times the distance of the particles in the incumbent atmosphere, and 9 times the distance of the particles in the water. This comparatively great distance of the inner and outer atmosphere arises from the great repulsive power of the latter, on account of its superior density, or its presenting 9 particles of surface to the other 1. When $\frac{1}{64}$ is absorbed, the distance of the atmospheres becomes 64 times the distance of two particles in the outer, or 16 times that of the inner. The annexed views of perpendicular and horizontal strata of gas in and out of water, will sufficiently illustrate these positions.

7. An equilibrium between the outer and inner atmospheres can be established in no other circumstance than that of the distance of the particles of one atmosphere being the same or some multiple of that of the other; and it is probable the multiple cannot be more than 4. For in this case the distance of the inner and outer atmospheres is such as to make the perpendicular force of each particle of the former on those particles of the latter that are immediately subject to its influence, physically speaking, equal; and the same may be observed of the small lateral force.

8. The greatest difficulty attending the mechanical hypothesis, arises from different gases observing different laws. Why does water not admit its bulk of every kind of gas alike?—This question I have duly considered: and though I am not yet able to satisfy myself completely, I am nearly persuaded that the circumstance depends upon the weight and number of the ultimate particles of the several gases; those whose particles are lightest and single being least absorbable, and the others more, according as they increase in weight and complexity*. An inquiry into the relative weights of the ultimate particles of bodies, is a subject, as

---

* Subsequent experience renders this conjecture less probable.

know, entirely new: I have lately been p
iry with remarkable success. The princi
d upon in this paper; but I shall just s
as far as they appear to be ascertained by

the relative Weights of the ultimate P
Gaseous and other Bodies.

lrogen - - - -
te - - - -
bon - - - -
monia - - - -
gen - - - -
ter - - - -
sphorus - - - -
sphuretted hydrogen - -
ous gas - - - -
er - - - -
eous oxide of carbon - -
ous oxide - - -
hur - - - -
ic acid - - - -
huretted hydrogen - - -
bonic acid - - -
hol - - - -
hureous acid - - -
huric acid - - -
buretted hydrogen from stagnant water
fiant gas - - - -

te I. fig. 1. the lower globes are to rep
water: the top globe represents a part
n four particles of water. Fig. 3. Incum
tmosphere—the particles marked with a d
n of air in the water—the particles mar
ss. Two representations are given: in
ogenous gas), the distance of particles
(oxygenous, nitrous, and carburetted hy
tance of particles 3 to 1.

II. fig. 1. Profile view of air in water,
ous gas, $\frac{1}{64}$ density: oxygenous, nitrous
hydrogenous gas, $\frac{1}{27}$ density.

IV. *An Experimental Inquiry into the Nature of Gravelly and Calculous Concretions in the Human Subject; and the Effects of Alkaline and Acid Substances on them, in and out of the Body.* By THOMAS EGAN, *M.D. M.R.I.A.*

[Continued from our last volume, p. 307.]

PART II.

THE bad effects of all acid and acescent substances being generally felt and acknowledged, we cannot be surprised that sufferers from these maladies should naturally expect an alleviation of their complaints from substances of a very opposite nature; or that, perhaps, in the general anxiety of mankind to discover a solvent of these concretions, the active agency of alkaline matters could not be overlooked. We accordingly find that, from the remotest antiquity up to this day, they were, and still are, though under various modifications, chiefly resorted to. Our antient physicians prescribed waters with mineral alkaline impregnation, such as Seltzer, Carlsbad, and others; and, in latter times, we find our own countrymen more particularly engaged in these pursuits. Lime water, recommended by White, (to whose numerous and interesting experiments I must beg leave to refer;) lime, and pure alkaline matter, forming the bases of the celebrated remedies of madam Stephens, Hartley, and others. And, in our own days, the caustic lixivium, again forgot, to make room for the more modern and fashionable introduction of both our alkaline sub- and super-carbonates; the vegetable, as in Faulknor's mephitic alkaline water, or in the crystallized carbonate of potash; the mineral, in a desiccated state, as recommended by my learned and indefatigable friend, Dr. Beddoes; or in that of the well known soda waters, first introduced in Geneva and Paris.

Now, in whatever of the above forms these saline matters are employed, their decided good effects are universally experienced and acknowledged. The *aqua mephitica alkalina* I consider the most valuable gift bestowed upon mankind

odern chemistry; and to Beddoes's desic
colleagues must join with me in ack
atest obligations. But how account for
or what can their *modus operandi* be?
. Carbonates, we have always been
exerted no solvent power on gravel
er; and this continues to be the opini
s well as medical chemists, to this day.
in his late elaborate work on this sub
to assert, (in mentioning the action of
upon uric acid,) "les carbonates alka
ction sur lui." Nor does the difficult
espect to the pure alkalies; for, in the
næ viæ, they must return again, to eit
saponaceous state. My ingenious fr
chemistry, Mr. William Higgins, (i
quoted,) emphatically exclaims, "Wh
ap? why not turn our attention to the
" With regard to the common alkaline
, it may be observed that the saturati
and that the uncombined portion of alk
ll exert its specific powers observable
ty, as has been so long since well expl
. This explanation, however, could no
tassa carbonata, or crystallized vegetab
roduced, and with equal success. May
withstanding its use as a test, and non
entertain some doubt of its complete sa
prepared with the most scrupulous care,
ine taste, and acts with energy on the
The carbonic may probably be too we
annul its alkaline property in any pr
an possibly unite them in the solid sta
y Mr. Kirwan, however, that this can
saturation is temporary, and continue
t recent state. This we now accomplis
ans, in the fluid one of our soda and
; where, indeed, the alkali may be
super-carbonated state. Now, the s

att

attendant also upon their exhibition, completely does away my former hypothesis; and we are left to conclude, that either the opinion of their want of action upon gravelly and calculous matter is unfounded, or that the animal œconomy may be possessed (among the multiplicity of its wonders) of some unknown chemical agency, whereby it may, in their course through the circulation, disengage their carbonic acid gas.

This would not appear more extraordinary than the formation of the different and most opposite secretions, such as bile and milk, from one and the same fluid; nor than what we every day observe to pass in the functions of the vegetable department of the organized kingdom. The *salsola kali*, *salicornia*, and other maritime plants, afforded to Chaptal's analysis, in their early state of growth, muriate of soda; when the plant was more advanced, this salt, with this excess of alkali; but in a full state of maturity, the same quite disengaged, and uncombined with muriatic acid. Here, then, we have one of our most refractory salts, and that resists the action of our greatest fires, completely decomposed by the vegetative powers of an humble plant.

In this state of uncertainty I determined upon a course of some experiments which might throw some light on this subject; and go to explain how, or upon what principle, alkaline earths or carbonates become remedies in those complaints. And here, again, I must bring to our recollection, that whatever retains the uric acid in a state of solution whilst in the body, must prevent the formation of gravel or calculous matter of that kind.

And to begin with lime water, so generally prescribed since the time of White. In this, the quantity of pure earth in solution (being only one grain in 700 of water) is so minute, and it is, withal, so readily decomposed, that we could not, *à priori*, expect much from its agency.

On conversing, however, with my friend Dr. Harvey on this subject, (of whose professional acumen it is unnecessary to make mention here,) he observed, with that strength of reasoning peculiarly his own: "Whatever may be the result of your future inquiries, can you, for a moment, imagine

icians of the first eminence, and of al
ill consent to tread in the path of empiri
in the use of this remedy, if they wer
by the irresistible evidence of a succe
bservation? or that the late Dr. Smy
great discernment, and extensive knowl
erally and promiscuously, prescribe lime
ravel, if he were not satisfied of its effi
e great similarity of these complaints?"

Experiment I.

ces of healthy urine was added one o
A similar quantity of urine was set
both in close vessels; temperature va
degrees, being in August 1799. In
f the slightest separation, or crystalliz
fter three, five, or seven days. Some
e standard after the third day, which
tity to the fifth.

Experiment II.

quantity of urine was added half an o
vater, with the same appearances as be
acid after several days. The standard d
tals on the third morning.

Experiment III.

quantity of urine were added two dra
ter, which, though insufficient to neut
phosphoric acid, yet seemed as effectual
paration of uric acid as the greater quan
former experiments.

Experiment IV.

ces of the urine of a child, six years old
ject to deposit gravel upon cooling,
hms of lime water, which effectually
ation of this matter, whilst the standard
sly this saline substance after three hou

Exper

Experiment V.

To three ounces of the same kind of urine as in the preceding, was added one drachm of lime water: the result the same as in the former. Some precipitation in the standard, as in the preceding experiment.

When we consider the small proportion of lime kept in solution in water, and that the lime water used in my experiments was far from being recent, we must be astonished at the minute quantity that proves sufficient to keep the uric acid in solution: but this wonder ceases when we recollect that the proportion of it in the above quantities of urine is extremely small, and that it is scarcely acid; as we may learn from the controversy that took place between two such able chemists as Pearson and Fourcroy on this subject. Finding, then, our common lime water exerting such powers in preventing the separation or crystallization of this substance, it occurred to me, that much more might be expected from barytic lime water, as containing a larger proportion of saline matter in solution; and that, though, from its poisonous effects in the carbonated state, the internal exhibition would be hazardous, yet it might prove an useful remedy when injected into the bladder. But how uncertain are our apparently best founded theories when not deduced from experiment!

Experiment VI,

To three ounces of urine was added one drachm of barytic lime water, which immediately seemed to decompose the whole, render it turbid, and give it the appearance of the *urina jumentosa*; for reasons easily and satisfactorily explained by Fourcroy, to whom I must refer. After two days I was surprised to find some small crystalline matter adhering to the sides of the glass; and, upon examining the copious precipitate from this re-agent, I found it blended with as much crystallized uric acid as appeared in the standard. A repetition of this experiment, both since and at that time, afforded the same results. Now the strength of barytic lime water is, to that of the common, nearly as 13 to 1; the former keeping in solution, at the temperature 60 degrees,

grains to the ounce. Has the barytic, w
nergy, less affinity for the uric acid th
rth? or does a superior affinity, to some
f the urinary compound, supersede its un

at the small quantity of stronthian lime
essed, did not permit me to extend my in

hen, that our alkaline earth of lime,
ible state of solution, and in the smalle
ctually prevents the crystallization, or k
lithic acid of urine: if we only suppos
e kidneys and bladder in the smallest qu
duce similar effects there, obviate the
f gravelly matter, or further accumula
calculous concretions of this kind.
v proceed to inquire into the effects of th
ed alkalies themselves. The action of the
nown and acknowledged, I shall content
eriment, and pass on to the latter.

Experiment VII.

nces of the urine of a child often dep
oling, were added ten drops of the *aq*
hops. After seven days no sign of sepa
ble in the standard after some hours.

Experiment VIII.

nces of urine were added three grains
carbonate of potash, the purity of whi
y Dr. Perceval and myself, and con
Mr. Kirwan, 1·23 grains of alkali. A
appearance of crystallized matter: s
after forty-eight hours.

Experiment IX.

e quantity of urine were added two gra
with the like result.
ure and carbonated, let us now proce
ated and sub-carbonated states.

Ex

Experiment X.

To three ounces of urine, in a well closed phial, was added half an ounce of the *aqua mephitica alkalina*, prepared according to Dr. Faulkner's proportions. No crystallized appearance after seven days. This result we might well expect, from the relative large proportion of its alkaline salt; having already seen equally good effects, from half an ounce only of Kinsley's soda water, containing a mere fraction of alkaline matter.

Experiment XI.

To three ounces of urine were added two grains of the common salt of tartar of the shops, containing, according to Mr. Kirwan, 0·82 of alkali. The same results as in the former experiments, even after six days.

Experiment XII.

Having no pure mineral alkali, three grains of the common crystallized soda of the shops, containing, according to Mr. Kirwan, 0·64 of alkali, were added to four ounces of urine. The result as in the former; which was equally produced by two grains only; and perhaps would have been equally so by one.

Wishing to be more fully convinced that the very large proportion of disengaged carbonic acid gas in our soda waters did not counteract the usual alkaline effects:

Experiment XIII.

To four ounces of the urine of the same child, which was generally surcharged with gravelly matter, I added half an ounce of Kinsley's soda water in its full state of effervescence: the phial well corked, and removed into a cold cellar, temperature 42 degrees. After four days, nay, a week, nothing but the usual calcareous sediment, without an atom of crystallized, or otherwise precipitated uric acid.

From the above experiments, then, we learn, that pure lime in the state of lime water, the pure alkalies, the subcarbonated, carbonated, and super-carbonated, all prevent the separation of the uric acid, by uniting probably with, and

g it in solution. That they should sti
in the super-carbonated soda water, i
d we must suppose that, in the temper
body, this superabundant gas (which,
is only retained by compression) would
l leave the alkali to exert its usual pro
uld presume, it happens.

t of soda water was poured into a larg
to the influence of the atmosphere in a
m 60 to 75 degrees. After two days it co
s red, and only ceased to do so at th
in Experiment X. we find it in its full
ossessing its alkaline influence on the u
ld be disposed to attribute to its very wea
nic acid in the fully carbonated and su
es, as well as to the very weak degree o
cid itself, rendering the most minute p
matter sufficient to its saturation. How
is obvious that the extraordinary quantit
these waters are surcharged, is undoubt
nd may probably prove dangerous. I
bject to these complaints) there is alway
cing spasmodic affections of the stomac
ly occurred; and if, to prevent it, we are
ous tinctures, and brandy, why not as v
aturation at once, and content oursel
g degree of it which exceeds but little

the predisposed to apoplexy less to ap
e cases we find our own physicians, as
e sister kingdom, preferring carbonate
l soda. But, recollecting that I am ac
, the part only of the experimenter, I s
onsider what the action of these saline s
e uric acid, in its concrete or calculou
few others of these concretions, whic
t nature, are of frequent occurrence,
The nature of those employed in the
ex

experiments was always previously ascertained and specified; they were also carefully weighed and dried, both before and after immersion in their several menstrua.

Dr. Percival, of Manchester, as well as others, having experienced the solvent power of the plain mephitic, or carbonated water, on urinary calculi, it was thought proper to repeat his experiments.

Experiment I.

A fragment of a calculus, weighing twenty-three grains, and of the uric acid kind, was suspended by a thread, for forty-eight hours, in Nooth's apparatus, already nearly filled with highly impregnated aërated water, and still exposed to a stream of carbonic acid gas: temperature 58 degrees. When taken out, and dried, weighed, as before, twenty-three grains.

Experiment II.

A fragment of a calculus, of the same kind, weighing forty grains and three quarters, was suspended, as before, in Nooth's apparatus, for forty-eight hours: temperature varying from forty to fifty-five degrees. On being taken out, and dried, was found to have sustained no loss.

Experiment III.

An entire calculus, of a rough and sandy appearance, chiefly of the uric acid kind, but with some extremely minute intermixed particles of the ammoniacal magnesian phosphate, weighing fifty-two grains, was suspended, as before, for forty-eight hours, in Nooth's apparatus. After being taken out, and dried, was found to weigh fifty-one grains and a quarter; so that there was here a loss of three quarters of a grain: undoubtedly of the ammoniacal magnesian phosphate.

Experiment IV.

Wishing to see whether even increased temperature would add to the solvent power of carbonic acid, a fragment of calculus, of the uric acid kind, weighing twenty-two grains, was immersed, as before, for forty-eight hours, in three ounces and a half of highly impregnated carbonated water,

in

osed phial, and laid on a sand heat whicl
temperature of 100 degrees. After bei
ied, the weight was found, as before, tw

ese experiments, then, we may conclude,
uric acid kind are insoluble in carbonat
r. Percival, whose character as a philos
physician, deservedly stands so high, m
pon concretions of a different kind; m
his experiments there was a loss of seve
w ounces of mephitic water, whilst none
ough in several pounds of that fluid.
perated upon some of a different and hi

Experiment V.

of a calculus, of the ammoniacal m
hing 100·5 grains, was suspended, as u
hours, in Nooth's apparatus: temper
Jpon being taken out, and dried, was f
3 grains; so that its loss amounted to
than seven grains three quarters. And
planation of the result of Dr. Percival'
upposing that the calculi he employed n
species; the extreme solubility of whi
nnocent a menstruum, should excite th
r young gentlemen, in the surgical dep
its solution by injections of carbonat
dder. To such safe trials they must b
e pleasing consideration that this kind
rtion of the human urinary calculi.
he water should not be too highly imp
den expansion of the gas under the hun
ght excite the bladder to reject it too
venience, however, must be in part ob
y of previously warming the injection
ture of 80 degrees; a precaution ne
But to return to the alkaline earths and

Experiment VI.

of a uric acid calculus was suspended,

eight hours, in four ounces of lime water: temperature as before. After being dried, was found to have lost seven grains three quarters; and the surface to be covered with a granular efflorescence, which, in drying, detaches itself. The calculus was so much softened as to leave little doubt of its entire destruction by a few more immersions. It was again suspended for a month, in the same quantity of lime water, in the temperature of the atmosphere only, without any renewal of the menstruum; when it was found to have lost twenty-four grains. Now, if the lime water had been frequently renewed, and its energy assisted by the standard heat of the human body, no doubt but it would have been entirely broken down in a much shorter time. We find, then, lime water not only preventing the separation of uric acid from urine, but acting powerfully upon it in its most compact form. How well founded, then, were the experiments of Whyte, as well as the opinion of Dr. Smyth; and how little deserving the latter the obloquy of his contemporaries for his predilection to it! Now this result, corresponding also with Scheele's, points it out to us as one of our most safe and active agents, when injected into the bladder with the necessary precautions. And we must feel surprised that no attempts of that kind have been made since the time of Whyte.

Experiment VII.

A fragment of calculus, of the uric acid kind, weighing seventy-nine grains and a quarter, was suspended, for forty-eight hours, in a mixture consisting of four ounces of distilled water and twenty-five drops of the weak *aqua kali puri* of the shops, which merely gave it an alkaline taste. It was then placed on a sand heat; temperature varying occasionally from 60 to 100 degrees. After being taken out, and dried, it weighed seventy-four grains and three quarters; so that the loss amounted to four grains and a half. This weak lixivium, it appears, then, operated upon it, acquired a yellow colour, a sweet taste, and precipitated, with a few drops of muriatic acid, a white sediment, easily recognizable by

ll, silky, needle-shaped, crystalline app
he uric acid.

Experiment VIII.

e fragment of calculus, after being well
as again immersed, for forty-eight hou
sisting of only twenty drops of *aqua k*
ces of distilled water, and under the sa
Upon being taken out, and dried,
e lost four grains and a quarter. The
lowish green colour, lost all alkaline tas
as before, with either the acetous or

Experiment IX.

nt of calculus, of the same kind, w
rains, was suspended, as before, for for
mixture consisting only of fifteen drop
o four ounces of distilled water, which
alkaline taste. After being taken out, an
to have lost one grain and three quarte
nsisting chiefly of the external laminæ
acted upon.

Experiment X.

e fragment, washed and dried, was ag
forty-eight hours, in a similar lixivi
e circumstances. The loss now amo
rains; and from this we learn how con
f the menstruum is increased by each su
so much so, indeed, that a few repetit
unite the laminæ, and cause them to
rulent state, easily voidable with the uri
sult, therefore, of this experiment let
the attention of our young practitione

[To be continued.]

V. *The Syphon applied to the Worm Tub as a Refrigerator; or, A Plan for conveying Water in any Quantity to a Worm Tub of the largest Dimensions, if perfectly Air tight.* By ALEXANDER JOHNSTON, *Engineer**.

A. FIG. 2. Plate II. The feed pipe of cold water.

B. The hot water, or waste pipe, the end of which must be about two feet lower than the feed pipe, to make it act with full effect.

When you commence work, you must shut the cocks, and fill the tub through a hole at top, and, of course, both pipes, and, when full, stop the hole at top, and open the cock's together; the water will then commence running, and continue as long as the supply holds good, as it acts in every respect on the principle of a syphon.

By this means pumps, horse mills, and other machinery, are rendered unnecessary for that purpose.

The application of this improvement is simple, and executed at a very little expense. The saving, I think, may be calculated at upwards of one hundred horses per annum, for the city of Dublin alone.

I have executed one for Nicholas Roe, esq. Marybone-lane.

ALEXANDER JOHNSTON.

Dublin, July 6, 1803.

VI. *Description of a Cometarium invented by* EZ. WALKER, *Esq.*

To Mr. Tilloch.

SIR, Lynn, Jan. 21, 1806.

I HAVE lately constructed a cometarium, which produces a more beautiful effect than any instrument of the kind that I am acquainted with. It is founded on a property of the convex lens, that I do not remember to have seen taken notice of by any writer on optics; and thinking that it may afford

---

* From *Transactions of the Dublin Society*, vol. iii.

sement to some of your readers, I have t
rouble you with a description of it.
part of my instrument that I shall descr
nahogany board, 14 inches in length an
xed to a stand in a perpendicular directio
nanner:
pin, sufficiently strong to bear the weigh
, is screwed into the side of a stand o
other end of the pin is tapped, and has
turns upon it. This pin goes throug
ottom of the board, and by means of th
brass washers the board is made fast to th
p of the board a hole 6 inches wide and
through it; the top of the hole being
p of the board.
double convex lens, 4 inches in diamete
l distance, set in a piece of mahogany
mounted in a square frame 6 inches withi
round within this frame upon two pins
ss that is made to stand upon a tabl
de fast to the board with screws around
ioned, in such a manner that one part of
one side of the board, and the other pa
That side of the board on which the
ll, for the sake of distinction, call the b
ment.
inches below the centre of this lens,
an inch in diameter, and 36 inches focal
the back part of the instrument, again
gh the mahogany board. As this lens
it is set in a small piece of wood that s
me fixed to the back part of the inst
f 1¼ inch diameter, and 40 inches focal
hole near the bottom of the board.

Directions for using the Instrument.

t the instrument upon a table, with
rds a white wall, at the distance of 2
rt of the great lens that is behind the in

until it makes an angle of about 50° with the top part of the frame in which it turns. Then place a lighted candle before the cometarium, at the distance of 18 feet, and the light which passes through the great lens forms a beautiful representation of the tail of a comet upon the wall; the light which passes through the small lens represents its head, and that light which falls upon the other lens is converged to a circular spot, which represents the sun.

When the instrument is turned round by hand on the pin which supports it, the comet revolves round the sun, the head and tail of the comet always keeping in the same position, with respect to the sun, in every part of its orbit.

And as no light is suffered to pass through the instrument except that which goes through the glasses, and no light being in the room except one candle, the luminous pictures are seen, upon the dark shadow made by the opaque parts of the instrument, exceedingly clear and well defined. The head and that part of the tail which joins to it are very brilliant; but this brilliancy of the tail gradually decreases towards its end, as represented in Plate III.

I am, sir, your humble servant,

EZ. WALKER.

VII. *A Description of a Property of Caoutchouc, or Indian Rubber; with some Reflections on the Cause of the Elasticity of this Substance. In a Letter to Dr.* HOLME [*].

Middleshaw, near Kendal,
Nov. 16, 1802.

SIR,

THE substance called caoutchouc, or Indian rubber, possesses a singular property, which, I believe, has never been taken notice of in print, at least by any English writer: the present letter contains my experiments and reflections on the subject; and should they appear to deserve the attention of your philosophical friends, I am certain you will take the trouble of communicating the paper to the Literary and Philosophical Society of Manchester.

---

[*] From *Manchester Transactions*, second series, vol. i.

scription of a Property of Caoutchouc.

rty I am about to describe depends on th
the caoutchouc which is used in the
eat increases the pliancy of the substan
contrary, renders it more rigid; so that
resin has been sufficiently warmed, it
more than twice its natural length, by a m
to its extremities; after which it will rec
ensions in a moment, provided one of the
soon as it has been stretched. This dis
nce may be produced by a degree of tem
heat of the blood; it is therefore nece
p of it, by steeping it for a few minutes i
holding it somewhat longer in the fist:
tions makes the resin pliant, and fits it
which is performed in the following ma
piece of caoutchouc a little heavier than
er, the temperature of which was 45
ntaining the resin and water was then pl
d when the contents of it were heated
caoutchouc floated on the surface.

Experiment I.

end of the slip, thus prepared, betw
fore-finger of each hand, bring the midd
ight contact with the edges of the lips,
it straight at the time, but not to s
d its natural length: after taking these
xtend the slip suddenly, and you will
e a sensation of warmth in that par
h touches it, arising from an augmen
in the caoutchouc; for this resin
er the further it is extended, and the
sess a high degree of sensibility, which
cover these changes with greater faci
of the body. The increase of tem
rceived upon extending a piece of cac
royed in an instant, by permitting th
in; which it will do quickly by virt
as oft as the stretching force ceases

soon as it has been fully exerted. Perhaps it will be said, that the preceding experiment is conducted in a negligent manner; that a person who wishes for accuracy will not trust his own sense of feeling in inquiries of this description, but will contrive to employ a thermometer in the business. Should the objection be started, the answer to it is obvious; for the experiment in its present state demonstrates the reality of a singular fact, by convincing that sense, which is the only direct judge in the case, that the temperature of a piece of caoutchouc may be changed by compelling it to change its dimensions. The use of a thermometer determines the relative magnitudes of these variations, by referring the question of temperature to the eye: experiments of this sort are therefore of a mathematical nature, and afford a kind of knowledge with which we have nothing to do at present; for we are not inquiring after proportions, but endeavouring to establish the certainty of a fact, which may assist in discovering the reason of the uncommon elasticity observable in caoutchouc. My essay or letter appears to be running into a long digression; the subject must therefore be resumed, and it will not be improper to premise the following simple experiment, in the present state of the inquiry, because it seems capable of affording no inconsiderable degree of insight into the plan which nature pursues in producing the phænomenon in question.

Experiment II.

If one end of a slip of caoutchouc be fastened to a rod of metal or wood, and a weight be fixed to the other extremity, in order to keep it in a vertical position, the thong will be found to become shorter with heat and longer with cold. The processes of heating, cooling, and measuring bodies are so well known, that I need not enter into the minuter parts of the experiment; it will be proper however to add, that an increase of temperature diminishes the specific gravity of the Indian rubber, and a loss of heat occasions a contrary effect in it, as I have proved experimentally. The knowledge of the latter fact leads me to conclude, apparently on reasonable grounds, that the pores or interstices of caoutchouc

arged by heat and diminished by cold ;
a slip of this substance which remains ex
or the application of force, happens to c
ssion of temperature, the capacity of its
ely or collectively, is augmented by the
ce in the figure of the thong. Now if
loric be admitted, it will follow from th
ents, that the phænomenon under consid
by the alternate absorption and emission
, in the same manner that ropes, the bl
as many more bodies, are obliged to c
themselves, by the alternate absorptio
vater. You will perceive by the tenour
servations, that my theory of this case c
ctly mechanical ; in fact, the explanatio
the mutual attraction of caloric and
former of which penetrates the latter
y part of it with the greatest ease and e
ch the resin is compelled to accommod
portion of the calorific fluid which is due
at any particular degree of temperatur
y the last remark to the phænomenon
, I may observe, that if a force be exert
chouc to alter the dimensions of its por
tion mentioned above will resist the effor
which this substance may be made to
d the retractile power which it posses
ns, show that its constituent particles
st themselves : but where there is motio
; consequently caoutchouc abounds with
or interstices, the magnitudes of whi
ause the specific gravity of the resin b
and greater with cold. Now if the dim
in a piece of caoutchouc can be le
g away part of the matter of heat w
e time, this new arrangement in the i
he slip will lessen its capacity for the m
sequently augment its temperature. I
ch a slip is increased by stretching it, ac

to the first experiment: the pores of it are therefore diminished; and the effort which it exerts at the time arises from the mutual attraction of the caoutchouc and caloric, which attraction causes an endeavour to enlarge the interstices of the former for the reception of the latter: hence it happens that the thong contracts longitudinally, according to the second experiment, and the redundant caloric is absorbed in the course of this operation, which again reduces the temperature. The preceding explanation agrees very well with the phænomenon, as it is stated in the beginning of this letter; and the theory receives additional confirmation from the following facts.

Experiment III.

If a thong of caoutchouc be stretched, in water warmer than itself, it retains its elasticity unimpaired; on the contrary, if the experiment be made in water colder than itself, it loses part of its retractile power, being unable to recover its former figure; but let the thong be placed in hot water, while it remains extended for want of spring, and the heat will immediately make it contract briskly. The foregoing circumstances may be considered as proving, that the elasticity of caoutchouc is not a constitutional quality of the substance, but a contingent effect, arising from the loss of equilibrium between the portion of caloric, which the resin happens to contain at any moment, and its capacity to receive that fluid at the same instant. The object of the present letter is to demonstrate, that the faculty of this body to absorb the calorific principle may be lessened, by forcibly diminishing the magnitudes of its pores, and this essential point of the theory may be confirmed by experiment; for the specific gravity of a slip of caoutchouc is increased, by keeping it extended while it is weighed in water.

JOHN GOUGH.

rks on Urine, and the Prognostics which d from it. By Dr. COLLENBUCH*.

tious ideas and erroneous opinions of the
en of many persons otherwise well info
f medicine, have made me think that it
l to explain to that part of the public w
e healing art, the phænomena which ar
r in a state of health or sickness, than to
cal rules and modes of treatment, whic
s than useful.

has been already partly fulfilled in dif
and anatomical treatises, destined for
hysicians; but let me only say a few wo
which too many persons have false ideas
the prognostics derived from it.

are destined to secrete from the bloo
y the name of urine, and which cann
lood without prejudice to the health.
rts of this fluid are different according
vidual, the season of the year, food, drin
ances; but in general the urine contains
urine, a little common salt, some calc
cus. These substances, according to ci
solved in more or less water. The colour,
rine vary according to the proportion of
the quantity of water. Thus, if suitable
lime, &c., are dissolved in a proport
ter, the result will be urine of a citron-y
a particular smell and taste, such as is
a person in a state of health; but if th
er is too great relatively to other subst
he urine becomes clearer, and the sm
Supposing a contrary mixture, i. e. if
dissolved in a smaller quantity of wat
rker colour, a stronger taste and smell,
more yellow, and of a deep or clear re
r substances, for example, a quantity

---

* From the German.

its colour will become of a saffron-yellow; if the bile is corrupted it will become green, and black if there be any mixture of blood in the urine, as, for instance, in putrid fevers.

Thus it is from the appearance of the urine we are enabled to judge of the nature of the forces of the body, and of the different combinations of its constituent parts; and on that account we have recourse to that fluid for the purpose of determining the state of the forces and humours of a patient.

1. Let us judge if these forces are active or not. We call *forces* those qualities of the body by which it performs its functions in the order and manner that are convenient. These forces may be more or less active. If we wish to give action to a force which is rather inert, we excite it by irritation. For example, when we feel a tickling in the soles of the feet, the toes and the foot immediately contract: since the skin or the fibres have this power of contracting themselves by the influence of irritation, it thence results, that the veins, which every where traverse the body, shrink, and consequently can only conduct a smaller quantity of the blood—merely the aqueous particles; and if a similar contraction takes place in the region of the kidneys, they will receive only the aqueous parts of the blood, and will secrete a clear urine like water. This is what takes place in fevers when shivering fits are experienced. But this quality of urine, which in this case announces an augmentation of forces, may, under other circumstances, announce a weakness and relaxation of the body, particularly in the kidneys, which then make their secretions less perfectly. Such urine may indicate great danger, and even death. If it comes from persons attacked by inflammatory fevers, it announces that the blood is so thick, viscous, or near being coagulated, that drinks cannot mix with it, and are voided almost without alteration. I mean to state hereafter the consequences which result from this difference in prognostics by means of urine.

2. The urine makes us acquainted with the nature of the constituent parts of the body, and of their relative quantities. It enables us to judge also if those parts be strongly united together, or if they are very soluble, and tend to corruption. In

case the urine will be of a deeper brown c
ack, and its smell will be as fœtid as the
n good health which has been allowed to
especially if in a warm exposure. If the
moment of evacuation, has already acq
and if the colour of it is dark brown, i
cluded that the humours of the body a
le, and have a tendency to putrefaction.
dent, any one of the constituent parts
augmented; if the secretion of a part of
hurtful or useless to the body, ought to
it, is arrested,—for example, the secret
the humours destined for other function
enter into the blood, it follows necessari
of the constituent parts of the blood,
urine also, will be changed: and thus th
r colours and other qualities.

n perspiration is suppressed, at least
should be exuded does not recoil into a
consequence will be an abundant discha
id urine.

nixed with the blood, supposing the bil
e the urine will become saffron yellow
the urine will become green or black.

is turbid, or of a clear brown, it indicat
of the body are disturbed, and that se
le in the proper manner. This urine, b
nblance to those of certain animals, is
sa.

f itself never proves any thing positively
of the malady must confirm the presum
pearance of the urine had enabled us to
wrong to examine first the urine, a
ns of the disease afterwards. If the ph
rtain signs of the urine as certain prog
, the patient may, in his turn, regard
of the ignorance of his physician.

hat I advance, I shall only cite an ex
dicates corrupted bile; or with one w

strained himself, or met with bruises or violent treatment, it indicates the absorption of coagulated blood. In putrid fevers it announces the dissolution of humours; it may also indicate the suppression of hæmorrhoides, or the courses: and in women in childbed, the suppression of the *lochia.*

But supposing that a man who has been severely beaten in some scuffle, or trampled under foot, attempts to heal himself by domestic medicines alone, but still feels a continuance of pains in his back and body; and that, after bathing the parts with wine, or using some similar remedy, he finds to his great surprise, at the end of three or four days, that his urine is black,—immediately he sends it to his physician and asks what is his disorder,—as if the physician could know it by divination. If the physician is not aware of the real cause of the disorder, he never will divine that the patient has received blows, that his back is marked with black and yellow spots, and that his body contains coagulated blood, of which a part, however, escapes into the urine.

He will more likely say, if putrid fevers are then raging, that the patient labours under that species of fever, and that he will die soon; or, perhaps, he will name some of the disorders above mentioned as giving this blackness to the urine, according as he finds more or less resemblance in the appearance of that fluid to the indications which we usually expect from it of various disorders.

IX. *Twenty-sixth Communication from Dr.* THORNTON, *relative to Pneumatic Medicine.*

To Mr. Tilloch.

No. 1, Hinde-street, Manchester-square, Feb. 18, 1806.

DEAR SIR,

HAVING saved the life of a first cousin, sir John Braithwaite, (who by mistake took a two ounce phial of laudanum for another draught,) by means of acids and the inhalation of vital air, I had confidence in this practice, and a few days back tried it in a very decided case.

A gen-

an in the vigour of life meeting with a
ent, had not the resolution to bear up a
nd he formed the horrid plan of self-m
lisappointing him in going off, he tool
audanum, which he had procured in s
lifferent shops. The apothecary in the
Ir. Goodchild of Park-street, was sent fo
scruple of vitriolated zinc, one of the qu
werful of our emetics. Not finding this
same dose, and repeated it until a drach
a scruple of tartar emetic; but such w
e stomach, that, as in the case of sir
no emetic effect was produced. In this
and I found the patient, a gentleman
ble birth, convulsed; his eyes swimm
clammy sweats came on; the pulse s
intermittent, and hardly beating afte
the head hung pendent upon the should
ered the house I ordered vinegar to be b
on juice to be procured; and diluting th
tle water, pressing down the tongue, I
nto the œsophagus, and afterwards I go
hree lemons mixed with a little water
acid was instantly perceptible; the eyes o
urned; the convulsion for the time ceas
having imbibed the oxygen from th
ording to Girtanner the irritable principl
wed, the *sine qua non* of irritability, it
he emetic, and the stomach disgorged it
acid being got down, and plentiful d
own up was free from all acidity, and
empire; but still a sense of great dro
th occasional spasms. The *vital air* v
hich Mr. Ince of York Buildings admin
tleman, after inhaling a gallon dilut
quantity of atmospheric, expressed
ived."—This being repeated gave the
he spasms recurred with diminished
nt "felt less languor." To be brief: h

a restless night, slept towards morning; awoke with head-ache; took his breakfast of coffee in bed; got up to dinner, and was as well as ever the following day.

Observations on this Case by Dr. Thornton.

1. Opium deprives the system of its oxygen; that is, it renders the fibres less attractive of that principle: and hence oxygenated metals, presenting less affinity to the fibres of the stomach, are not decomposed, and fail of counteracting the fatal effects of opium. The vegetable acids easily give out their oxygen; that is, the elective attraction is greater here, and they, therefore, at once counteract the effects of laudanum.

2. I have had two cases where this poison has been taken into the stomach, and tried acids with the same marked benefit; and the bad effect of the laudanum was soon removed, especially when the vital air has been inhaled.

3. I am called by Dr. Rowley "*vital air and gas mad*;" but stand not alone, as Dr. Beddoes assures me, in a letter last week received, "that he continues to order the different airs in various diseases, of which practice he entertains the same favourable opinion as ever."—Dr. Rowley calls my refutation of his cases* personal scurrility and abuse:—can any thing be more so than branding regular physicians with the appellation of *madness?*

I remain, sir,
Your obedient humble servant,
ROBERT JOHN THORNTON.

X. *On a new Black Dye to be applied to all Kinds of Linens and Stuffs. By Mr.* HERMBSTAEDT, *Berlin*†.

THE black colours which are commonly applied to linen and cotton stuffs are composed of iron and vinegar. Their base is always oxide of iron, which is mixed with decoctions

---

* My new work, in answer to Dr. Rowley, is entitled Vaccinæ Vindicia, or A Vindication of the Cow-pock.

† From *Biblioth. Phys. Economique*, an xiv. no. 2.

ferent kinds. All these colours incline
, and they resist but feebly the action o
and of acids. The tincture which I
d which I use daily in dyeing all kin
r wool stuffs to an unalterable black, em
ion of the oxide of iron with that of
igneous acid.

paration of the Pyro-ligneous Acid.

lated retort made of plate iron, or of cast
r, place it in a furnace in such a manne
rfectly free, and the bottom receive di
fire. It must be luted carefully, and
duced into the retort some chestnut woo
. The distillation then commences
fire, which is progressively increased
sses into the receiver. The acid wh
ceiver, mixed with a kind of oil, may
t by a filter of gray paper: the wood
rcoal in the retort.

Preparation of the Oxide of Iron.

ounds of vitriol (sulphate) of iron, very
of rain water. Dissolve in like man
sh in 12 pounds of filtered water. Thes
n well mixed, will appear at the beginn
but in a little time the surface exposed
dark red colour; then pour the whol
the oxide which will remain after the
ght to be washed in a great deal of wa
adhering salt. Leave this oxide expo
ction of the atmosphere, which will re
d oxide.

eparation of the Oxide of Copper.

this oxide, take a pound of blue vit
ate of copper), which dissolve in 12
make it boil, and mix with it a po
with potash, and you will obtain a
ich must be well washed after being fil

Prep

Preparation of the Mordant for Black.

Take three parts of the oxide of iron and one part of the oxide of copper: triturate them in a marble mortar, and pour on them the necessary quantity of pyro-ligneous acid to dissolve them. Filter the whole to separate the thick parts, and the mordant is made.

Application of this Mordant in dyeing Black.

Steep the stuffs intended to be dyed in this mordant thickened at pleasure. Afterwards proceed to the dyeing in the ordinary decoctions made with different dye-woods. The colour obtained will be a very beautiful black, and almost unchangeable by all chemical agents. If the black is meant to serve for printing stuffs or cloths, it is thickened very much, and by mixing it with different tinctures of dye-wood, it will form a black equally beautiful and lasting.

XI. *New Experiments on the Respiration of Atmospheric Air, chiefly with respect to the Absorption of Azote and the Respiration of Gaseous Oxide of Azote. By Professor* PFAFF, *of Kiel*[*].

THE great discoveries in pneumatic chemistry, and the applications, as ingenious as useful, which have been made of those discoveries to explain the phænomena of the œconomy of organized beings (above all, of animal œconomy), and the careful researches of the most distinguished naturalists, have contributed much to clearing up the doctrine of the chemical effects of respiration. There has been a general agreement among physiologists on some of the most essential points of this theory, as well as upon the production of carbonic acid, the employment of oxygen gas, and the production of animal heat which depends on it. But, notwithstanding the zeal of naturalists, there are still some points which are not sufficiently clear; and the want of agreement in the results of experiments on those points proves that it was necessary to

---

[*] From the *Annales de Chimie*, No. 164.

efforts to remove those errors, and to d
ırces. The researches of the celebrated
succeeded for this end; and his "Res
ıd Philosophical, chiefly concerning
&c." form, in this point of view, a new
cal doctrine of respiration. The celebrat
3ibliotheque Britannique have shown th
he value of these researches by giving an
very minute and instructive, in their ex
ıd the manner in which Berthollet has gi
act in the *Annales de Chimie* ought to
all chemists on the work of Mr. Davy
ıat were found in the results of precedi
ı the quantity of carbonic acid produced
ation, were less important, and might
ıe difference of vital powers in differen
have been made subjects of these experi
ɔoint of view, a revision of these expe
consequence. But the part which azo
he act of respiration had been too little
mists. It had been common to attribu
ive part. Goodwyn alone believed that
ery considerable absorption of azotic ga
nts had not been made with all due exa
much in contradiction with the experim
guin, Abernethy, Fothergill, Menzies,
tention. The experiments made on th
f phosphorus, which did not succeed i
and which is so much favoured by the
azotic gas of the atmospheric air, migh
ı determining the service which this grea
renders in respiration. And a notice, u
ɔrt, of the results of the last experim
Lavoisier upon respiration, supports th
t. According to his results, a greater q
ı was decomposed in the same time by
he atmospheric air than by the respir

---

xix. xx. xxi. in the department of Arts and Scienc oxygen gas. But hitherto we had only had probabilities, or results of which the solidity could not be properly ascertained. It is to Davy that we owe an exact and well founded knowledge of the active part which azotic gas performs in the act of respiration. But the more that these results were new and interesting, the more they deserved to be confirmed by the agreement of the experiments of other chemists; and it was from this view that I undertook, last winter, a series of experiments on the respiration of atmospheric air, and the respiration of the gaseous oxide of azote, of which I submitted the principal results to the National Institute.

Experiments on the Respiration of Atmospheric Air and of Oxygen Gas.

These experiments have been undertaken in the academical laboratory of the university of Kiel, (which is provided with all the exact apparatus of modern chemistry,) for the most part in common with my scholars, and particularly with one of them of the name of Dierks, who made himself most frequently the subject of experiments.

That I might determine with exactness the changes which the atmospheric air undergoes by respiration, and be able to decide the absorption of azotic gas, it was necessary to set out, as from a solid foundation, with the diminution which a determined volume of atmospheric air experiences by respiration. It is therefore the first point to be determined by exact experiments.

1. There were respired 170 cubic inches of air (Paris measure) from one of the great reservoirs of a gasometer constructed at Paris (after the model of that of Charles, upon water covered with oil, to hinder the absorption of carbonic acid gas produced by respiration), once in the space of from 10 to 12 seconds. The diminution was 4·72 cubic inches, $= \frac{1}{36}$ of the primitive volume. This experiment, repeated twenty times in the same manner, afforded the same result.

2. 144 cubic inches were respired in the space of from 10 to 12 seconds; the diminution was 4 inches, $= \frac{1}{36}$ of the whole volume.

3. The same volume was respired twice during 22 seconds. The diminution amounted to 8 cubic inches, $= \frac{1}{18}$ of the

ume. The same volume, having been re
uring 30 seconds, the diminution amour
ies, = $\frac{1}{12}$ of the primitive volume.

ubic inches were respired three times
he diminution was 6 cubic inches, = $\frac{1}{1}$
ume.

ic inches were respired four times duri
diminution amounted to 20 cubic inches
as repeated several times. The diminuti
's the same, 18, 19, 21, or 20 cubic i

ic inches being respired during 50 secon
d four small respirations, were diminisl
their primitive volume.

ic inches underwent, at twelve respirat
diminution of 24, = $\frac{1}{12}$.

lts agree very well with those obtained
diminution of air by respiration. Davy
on by a single respiration = $\frac{1}{45}$. By r
d for a minute, the diminution was =
ess of the diminution does not depend al
ng which a given volume of air is respir
the greatness of the volume itself: a
ught to be relatively as much less as the
inhaled is greater. There is undoubtedly
r in the conclusions of Abernethy, inasn
o the expired air a greater volume than
haled. And the calculations of Goodw
tenable grounds, since he supposes the v
equal.

ine comparatively the diminution of oxy
, 170 cubic inches of oxygen gas, draw
vere respired in the same manner, and u
stances, as the above (*vide* 5.) 170 cubi
ic air. The diminution amounted to
e other experiments to 33, 29, 31 :
, to $\frac{2}{11}$ of the primitive volume.

ution, being established in a precise
sis for determining the absorption of az
cubic inches were respired once, and

during a space of from 10 to 12 seconds; and the middle quantity of the expired air was received over mercury. In this respired air the constituent parts in a hundred were 4·16 of carbonic acid gas; 16·55 of oxygen gas absorbed by slow combustion of phosphorus; and 79·19 of azotic gas. An eudiometrical experiment, made at the same time, gave the following proportion in the atmospheric air: 1 carbonic acid, 21 oxygen gas, 78 azotic gas. The total diminution of the air was, according to the preceding experiments (1.) = $\frac{1}{36}$. We find, therefore, the true quantity of azotic gas by the following proportion: $36 : 35 = 79·19 : x = 76·99$.

By subtracting these 76·99 from 78, the primitive quantity of azotic gas, we have a deficiency of 1·01; the volume of air before respiration being supposed to be divided into 100 parts. As the quantity of air inspired was = 80 cubic inches, the absolute diminution of azotic gas by a single respiration is found by this proportion, $100 : 80 = 1·01 : x$ = 0·808 cubic inch.

9. In another experiment 60 cubic inches were respired once in the space of from 10 to 12 seconds, and the latter portion of expired air was received over mercury. The proportion of constituent parts in 100 were, 4·68 of carbonic acid gas, 17·68 of oxygen gas, 77·74 of azotic gas. An eudiometrical experiment made at the same time, gave, in 100 parts, 1 carbonic acid, 22 oxygen gas, 77 azotic gas. To find the true quantity of azotic gas it is necessary to diminish the 77·74 of azotic gas by $\frac{1}{36}$, which gives, by proportion, $36 : 35 = 77·74 : x$. This quantity = 75·58, subtracting the quantity of azotic gas before respiration, leaves a loss of 1·42, supposing the volume of air to be divided into 100 parts. The true diminution is therefore found by the following proportion, $100 : 60 = 1·42 : x = 0·852$ cubic inch.

10. Thirty cubic inches were respired, in the same manner, three times during 16 seconds. The air which was expired contained, in 100 parts, 5 of carbonic acid gas, 14·5 of oxygen gas, 80·5 of azotic gas. The atmospheric air contained, according to an eudiometrical experiment made at the same time, 1 of carbonic acid gas 20·975 of oxygen gas,

, 80·025 azotic gas. We have, then, b
portion, 12 : 11 = 80·5 : 73·79; the
35. And in cubic inches by proporti
35 : x = 1·2705.
These experiments, which were frequent
ays gave the same result, establish, ther
absorption of azotic gas in the act of
active part which this gas performs. V
same time, more easily why the azotic g
h other mephitic gases, is so little adver
our lungs. According to the experim
Seguin, animals supported life very wel
parts of azotic gas with 1 of oxygen; a
mals were suddenly suffocated in a mixt
gen gas, 45 of azotic gas, and 15 of c
understand, at least in some degree,
cts of the gaseous oxide of azote. W
sformation of chyle, being less animaliz
he lymphatic part of the blood, to be
ized and very much azotized by the a
However, the quantity of azotic g
gle respiration is not very considerabl
fectly with the experiments of Davy,
pirations of a volume of 161 cubic inc
e than 5·1 cubic inches of azotic gas.
1. To determine the quantity of carbo
ed by the respiration of atmospheric air,
e respired once during 10 or 12 secon
r the mercury in the expiration. Lim
8 in 100 parts. This experiment, sever
e the same result. The latter portior
smitted frequently through lime water,
ution of 4·9 in 100 parts.
2. Twenty cubic inches, three times
ly during 10 seconds, showed no more
ic acid gas.
3. 170 cubic inches were respired four
nds, and there was obtained $\frac{5\cdot8}{100}$ of car

14. 170 cubic inches were respired from a bladder eight times in a minute. The lime water absorbed $\frac{8.2}{100}$.

This quantity of carbonic acid produced by respiration gave a term of comparison to determine the quantity of decomposition of oxygen gas in the respiration of the same quantities of atmospheric air and of pure oxygen. The preceding experiment (7.) had denoted that the diminution of oxygen gas was more considerable than that of atmospheric air. According to this, one might expect, with the appearance of probability, that the production of carbonic acid gas should be also more considerable; which was confirmed by direct experiments.

15. 170 cubic inches of oxygen gas obtained from manganese were respired four times during 50 seconds: the diminution was 30 cubic inches. The quantity of carbonic acid which was produced amounted to $\frac{8.9}{100}$. The atmospheric air, respired in the same manner, and under the same circumstances (13.), contained only $\frac{5.8}{100}$ of carbonic acid.

16. Seventy cubic inches, respired from a bladder in the space of 50 seconds, even gave $\frac{8}{100}$ of carbonic acid.

Experiments on the Respiration of Gaseous Oxide of Azote.

The gaseous oxide of azote was obtained, according to the process of Davy, from crystallized nitrate of ammonia. This nitrate of ammonia gives products very different in different temperatures. I undertook on this subject an important operation, which I submitted to the inspection of the National Institute. I have only to remark, by the way, that we obtain at the commencement oxygenated muriatic gas, if the nitrate of ammonia is not entirely free from muriatic acid: that at a temperature which does not go beyond the 220th degree of the centigrade thermometer we obtain the gaseous oxide of azote in very great quantity, and very pure, and without a mixture of those white vapours which have the taste of mustard; but at higher temperatures, and above all at a red heat, the gaseous oxide of azote is not disengaged, but there are formed nitrous gas and white vapours,

uite uncommon in the analysis of whi
ngaged.

To prevent all explosion, I constantly
mmonia with very pure sand. To obtai
f azote very pure, the distillation is pe
ath, and the fire is managed with grea
vhole succeeds well, the gas is so pure th
t immediately. It has an agreeable taste
inous. If it is mixed with the white vap
xcess of heat, it must be left a sufficient ti
fter two or three hours it may be respir
he effects which Davy has observed, ar
escribed in so interesting a manner in
Bibl. Britannique, tome xvii. p. 406.),
onfirmed in my experiments. Many pe
pired this gas have been intoxicated ver
nto a state of ecstasy very extraordinary
thers have resisted its effects a little m
idual was not at all affected by it. This
as always passed without leaving a sen
m still continuing these experiments. I
hat this gas may become a very importa
ncholic persons. I will not fail to com
eries of experiments to the National Ins

II. *Additional Experiments and Rema* *Substance which possesses the principa* *perties of Tannin.* By CHARLES *F. R. S.*

[Continued from our last volume,

§ IV.

MADE several unsuccessful attempts to
ubstance by means of oxymuriatic acid
ppeared certain, that although a varie
atter could be produced by the actio
n resinous substances, yet the most

nitric acid, which readily formed it when applied to any sort of coal.

But I nevertheless suspected, that possibly this substance, or something similar to it, might be produced without absolutely converting vegetable bodies into coal; for it seemed, as I have observed in my former paper, that this only served to separate the carbon in a great measure from the other elementary principles (excepting oxygen) which were combined with it in the original substance, and thus to expose it more completely to the effects of the nitric acid, as well as to prevent the formation of the various acid products, which are so constantly afforded by the organized substances when thus treated. At first I had some thoughts of employing touchwood in this experiment: but not being able immediately to procure any, it occurred to me that indigo might probably answer the purpose; for from some experiments made by myself, as well as from those described by Bergman*, I well knew that the proportion of carbon in this substance is very considerable. The following experiment was therefore made:

1. On one hundred grains of fine indigo which had been put into a long matrass, one ounce of nitric acid diluted with an equal quantity of water was poured; and as the action of the acid was almost immediate and extremely violent, another ounce of water was added. When the effervescence had nearly subsided, the vessel was placed in a sand-bath during several days, until the whole of the liquid was evaporated.

On the residuum, which was of a deep orange colour, three ounces of boiling distilled water were poured, by which a considerable part was dissolved.

The colour of the solution was a most beautiful deep yellow, and the bitter flavour of it surpassed in intensity that of any substance in my recollection; it was examined by the following reagents:

Sulphate of iron produced a slight pale yellow precipitate.

Nitrate of lime only rendered it a little turbid; after which

---

* *Analysis Chemica Pigmenti Indici.* Opuscula Berg. tom. v. p. 36.

mall portion of white powder subsided
aracters of oxalate of lime.

Muriate of tin produced a copious white
erwards changed to a yellowish-brown.

Acetite of lead formed a very beautiful
ured precipitate, which possibly may
gment.

Ammonia rendered the colour much de
e liquor became turbid, and a large quan
iculated crystals was deposited, which
ter did not precipitate lime from its solu
The flavour of these crystals was very bi
em to be composed of ammonia combin
inciple first noticed by Welther*.

Lastly, when dissolved isinglass was a
lution of indigo, it immediately became
bright yellow substance was gradually dep
e sides of the glass jar with a tough el
s insoluble in boiling water, and posses
gelatine combined with tanning matter.

By this experiment I therefore ascertai
the artificial tanning substance could
eviously converting the vegetable body
ve since discovered, that although ind
elds this substance than most of the othe
t in fact, very few of these can be regar
hen subjected to repeated digestion and
tric acid.

2.—A. In my former paper I have sta
sin, when treated with nitric acid, yiel
lution with water, which did not precipi
at it was requisite to develop part of t
ate of coal by sulphuric acid, before an
bstance could be produced; but having
these experiments, I repeated the abstra
veral times, and then observed, that the
water acted upon gelatine similar to the

---

* Thomson's System of Chemistry, 2d edit.

which has been described, and formed a tough yellow precipitate, which was insoluble in boiling water.

With other reagents the effects were as follow:

Sulphate of iron, after 12 hours, formed a slight yellow precipitate.

Nitrate of lime did not produce any effect.

Muriate of tin, after 12 hours, afforded a pale brown precipitate.

And acetite of lead immediately formed a very abundant precipitate of a yellowish white colour.

I repeated this experiment on common resin, and remarked, that during each distillation nitrous gas was produced, whilst the strength of the acid which came over was diminished: the cause therefore of the change in the properties of the resin seemed to me very evident, and I was induced to extend the experiments to various resinous and other substances; but as the process was uniformly the same, I shall only notice the principal effects.

B. Stick lac, when separated from the twigs, and treated as above described, copiously precipitated gelatine.

C. Balsam of Peru during the process afforded some benzoic acid, and gelatine was precipitated by the aqueous solution.

D. Benzoin also, after the sublimation of some benzoic acid, yielded a residuum, which with water formed a pale yellow solution of a very bitter flavour.

This solution with sulphate of iron afforded a slight pale yellow precipitate.

With nitrate of lime not any effect was produced.

The solution with muriate of tin became turbid, and a small quantity of brownish-white precipitate subsided.

Acetite of lead immediately produced a copious pale yellow precipitate.

And solution of isinglass formed a dense yellow precipitate, which was insoluble in boiling water.

E. Balsam of Tolu, like balsam of Peru, and benzoin, afforded some benzoic acid; and the residuum being dissolved in water was found to precipitate gelatine.

F. As the results of the experiments on dragon's blood were

ere somewhat remarkable, I shall here
late them. One hundred grains of pur
duced to powder, were digested in a long
unce of strong nitric acid; the colour im
deep yellow, much nitrous gas was evo
e effervescence one ounce of water wa
stion was continued until a deep yel
ained; and the matrass being still kept i
illiant feather-like sublimate arose, wh
ore than six grains, and had the aspect
rties of benzoic acid*.

The residuum was of a brown colou
rmed a golden yellow-coloured solution
f lime was not affected.

With sulphate of iron it afforded a bro
pitate.

With muriate of tin the result was simi

With acetite of lead a lemon-colour
roduced.

Gold was precipitated by it in the metal
lass vessel acquired a tinge of purple:

And dissolved isinglass produced a de
hich was insoluble in boiling water.

A portion of the same dragon's blood
heat in the same matrass, but not any
oic acid could be discovered. I am th
elieve, that in the first experiment it was
uct, and not as an educt: a fact which
uspected.

G. Gum ammoniac afforded a brown
he flavour of which was very bitter and

By sulphate of iron, this solution only
olour, but did not form any precipitate.

---

* According to these experiments, dragon's bloo
ith benzoin and the balsams; but as the samples of
recisely similar, it would be proper to examine eve
as employed in my experiments, was a porous r
as sent to me by Messrs. Allen and Howard, of
ard street.

Nitrate of lime rendered it turbid, and produced a slight precipitate.

Muriate of tin formed a copious yellow precipitate.

Acetite of lead produced a similar effect:

And gelatine yielded a bright yellow deposit, which was completely insoluble by boiling water.

H. Asa fœtida yielded a solution which also precipitated gelatine like the substances above described.

I. Solutions of elemi, tacamahac, olibanum, sandarach, copaiba, mastich, myrrh, gamboge, and caoutchouc, were next examined; but these, although they precipitated the metallic solutions, did not affect gelatine. It is possible, however, that they might have produced this effect, had they been subjected to a greater number of repetitions of the process.

K. Sarcocol, in its natural state, as well as the gum separated from it by water, when treated with nitric acid, did not precipitate gelatine; but produced effects on the metallic solutions similar to the above-mentioned substances.

L. Gum arabic afforded oxalic acid, but not any of the tanning matter.

M. Tragacanth yielded an abundance of saclactic acid, of oxalic, and of malic acid, but not the smallest vestige of the artificial tanning substance.

N. Manna, when treated with nitric acid in the way above described, afforded oxalic acid, part of which was sublimed in the neck of the vessel.

The residuum with water formed a brown solution, which yielded a pale yellow precipitate with sulphate of iron.

Muriate of tin produced a pale brown precipitate.

Acetite of lead formed one of a brownish-white hue.

Lime was copiously precipitated from the nitrate of lime in the state of oxalate; but not the smallest effect was produced on solution of isinglass.

O. Liquorice however afforded a different result; for although the solution after the process with nitric acid resembled in appearance that which was yielded by manna, yet the effects were not the same.

Sulphate of iron, after twelve hou
brown precipitate.

Muriate of tin had a similar effect.

Acetite of lead formed a brownish-r

Nitrate of lime also occasioned a br

And solution of isinglass rendered it
duced a yellowish-brown precipitate,
boiling water, and possessed all the ot
tine combined with the tanning substa

P. Guaiacum, the properties of wh
many respects, afforded results (when
in the manner which has been describ
resins, although its external and gene
indicate that it appertains to those bodi

Nitric acid acted upon it with g
speedily dissolved it. The residuum
obtained, was also found to be alm
water, and the solution acted on the m
which have already been noticed; but
only a very slight precipitate, which
solved by boiling water; and the rem
being evaporated, yielded a very larg
lized oxalic acid; so that in this r
found to resemble the gums, and to
resins*.

§ V.

As many vegetable substances whe
coction a liquid which in appearance
artificial tanning matter when dissolv
some of the common dried peas, hor
wheat flour, the decoctions of which
any precipitate by solution of isinglass.

---

* The properties of guaiacum which have bee
which were previously known, appear to indica
stance of a nature distinct from the resins, balsa
So remarkable indeed is this substance, that
ments on the whole of its properties may justly
mical desiderata.

Even the decoction of coffee did not yield any precipitate by this method, until several hours had elapsed, and I found that the precipitate so formed was permanently soluble in boiling water. But to explain this, we must recollect, it is extremely probable, that some peculiar nicety is required in the roasting of such bodies before the tanning substance can be developed; and this seems to be corroborated by some experiments which I made on the decoction of a sort of coffee prepared from the chicorée (I suppose endive) root, which was given me by Sir Joseph Banks; for although this decoction did not afford an immediate precipitate with solution of gelatine, and although the precipitate was also apparently dissolved by boiling water, yet upon cooling, the same precipitate was reproduced in its original state. I am therefore inclined to believe, that the tanning substance is really developed in many of the vegetable bodies by heat, but that a certain degree of temperature, not very easy to determine, is absolutely requisite for this purpose.

Before I conclude this section, it may be proper to observe, that when a small quantity of nitric acid was added to any of the above-mentioned decoctions, and when these had been subsequently evaporated to dryness, and afterwards dissolved in distilled water, they were converted into a tanning substance perfectly similar to that which is produced by the action of nitric acid on the varieties of coal.

§ VI.

In the preceding paper, a variety of the tanning substance was slightly noticed, which was formed by the action of sulphuric acid upon common resin, elemi, amber, &c. &c. and as an instance has occurred of the formation of the same substance from camphor, accompanied by circumstances which tend to increase our knowledge of the properties of the latter, I shall here describe this experiment.

Experiment on Camphor with sulphuric Acid.

The effects produced on camphor by sulphuric acid have been but very superficially examined; for all that has hitherto been stated amounts to this, that camphor is dissolved by su-

lphuric acid, that a brown or reddish-
rmed, and that the camphor is preci
om this solution by water. These fac
late to a certain period of the operation;
ntinued, other effects are produced,
scribe.

A. To one hundred grains of pure c
nall glass alembic, one ounce of con
id was added. The camphor immediate
d gradually dissolved, during which the
anged to brownish-red, and afterwar
is period scarcely any sulphureous acid
about one hour the liquid became
uch sulphureous acid gas was then pro
ed to increase during four hours, when
e a thick black liquid, at which period
pearance of camphor could be perceive
e sulphureous acid. After two days,
e alembic had not been heated, there
teration, unless that the production o
as much diminished. The alembic wa
nd-bath moderately warm, by which
ureous gas was obtained, but this also s
fter the lapse of two other days, I a
nces of cold water, by which the liqu
ddish-brown, a considerable coagulum
bsided, the odour of sulphureous gas,
easure had still prevailed, was immedia
as succeeded by one which resembled a
vender and peppermint.

The whole was then subjected to gr
ring which the water came over stro
th the odour above mentioned, accom
wish oil, which floated on the top of it,
could be ascertained, amounted to abo

B. When the whole of the water was
as again a slight production of sulphur
ded two ounces of water, which I drew
t did not obtain any of the vegetable e

has been mentioned, nor did the odour of it return. I therefore continued the distillation until a dry blackish brown mass remained; this was well washed with warm distilled water, by which, however, nothing was extracted; but when two ounces of alcohol were digested on it during twenty-four hours, a very dark brown tincture was formed.

The residuum was digested with two other ounces of alcohol in like manner, and the process was repeated until the alcohol ceased to act.

The residuum had now the appearance of a compact sort of coal in small fragments, it was then well dried, and after exposure to a low red heat in a close vessel weighed fifty-three grains.

C. The different portions of the solution formed by alcohol were added together, and being distilled by means of a water-bath, a blackish brown substance was obtained, which had the appearance of a resin or gum with a slight odour of caromel, and weighed 49 grains.

The products therefore which were thus obtained from 100 grains of camphor when treated with sulphuric acid, were,

	Grains.
A. An essential oil which had an odour somewhat resembling a mixture of lavender and peppermint, about - - - - - -	3
B. A compact and very hard sort of coal in small fragments - - - - -	53
C. And a blackish brown substance of a resinous appearance - - - - -	49
	105

From this statement it appears, that there was an increase in the weight amounting to five grains, which I attribute partly to oxygen united to the carbon, and partly to a portion of water so intimately combined with the last product, that it could not be expelled from it by heat without subjecting it to decomposition. The properties of this substance were as follows:

1. It was extremely brittle, had somewhat of the odour

aromel, the flavour was astringent, an ved in cold water, and formed with it a wn solution.

. This solution yielded very dark bro addition of sulphate of iron, acetite o , and nitrate of lime.

. Gold was copiously precipitated by it the metallic state; and,

. By solution of isinglass, the whole w itated, so that, after three or four h ter only remained.

The precipitate was nearly black, and ling water; from which property, as ct produced upon prepared skin by th dent that the substance thus obtained fr ariety of the artificial tanning matter, t which may be obtained from re ans of sulphuric acid. But it must be t of tanning substance seems to act n than that which is prepared from nces by nitric acid, and the precipitate duces with solution of gelatine is m s tenacious than that which in like ma latter.

It is however remarkable, that when a ric acid was added to the solution of ned from camphor, and when, after ness, the residuum was dissolved in wn liquid was formed, which acted i lar to the tanning substance obtained coal by nitric acid.

[To be continued.]

XIII. *On the Oxides of Gold, Tin, and other Metals; with Hints for extending their Uses in Dyeing. Communicated in a Letter to M.* BERTHOLLET *by M.* JOHN MICHAEL HAUSSMAN *.

I BELIEVE that I am as well founded as yourself in admitting of intermediate terms of oxidation between the minimum and maximum of several metallic substances. I shall, by-and-by, cite an example of the oxide of tin at the minimum precipitated from its muriatic solution, and redissolved by an excess of caustic potash; the alkaline metallic solution of which I have already mentioned in my observations upon the Adrianople red, inserted in the *Annales de Chimie* †, as well as in another memoir upon the coloured oxides of tin, given to the public in the *Journal de Physique*. In avoiding to dilute the muriatic solution of tin too much with water, and employing a solution of caustic potash very much concentrated, a considerable quantity of caloric disengages itself during the mixture of these two liquors: one portion of the tin precipitates itself in the metallic state, while the other remains in solution in a state of intermediate oxidation. This alkaline solution has so strong an affinity for oxygen, that it changes into a gray colour the yellow oxide of gold fixed upon a piece of cotton by means of ammonia, while a similar yellow piece does not change its colour when allowed to soak in a pure liquor of caustic potash. The same change takes place upon plunging a small piece of cotton, which had been saturated with a solution of gold, well squeezed and dried, into an alkaline solution of tin. The same effect will follow if we pour into this alkaline solution a solution of gold diluted with water.

The change of the yellow colour of the oxide of gold by the alkaline solution of tin is not the only proof of the intermediate oxidation: this liquor, besides, possesses the property of extracting the blackish brown colour of the oxide of manganese fixed upon a piece of cotton by an alkaline pre-

---

* From the *Annales de Chimie*, No. 166.

† See Phil. Mag. vol. xii. and vol. xviii.

cipitate.

pitate. All these changes will take pl
, before performing the precipitation ar
e liquor of caustic potash, the muriatic
luted with six or eight parts of water.
ill be no perceptible extrication of calor
e no precipitation of tin in a metallic stat
e oxidation of which approaches to the
eserves in general, without any precipit
queous transparency. Exposed for a lo
ospheric air, it does not lose the propert
llow oxide of gold into gray, and of extr
own colour of the oxide of manganese fi
f cotton.

The oxide of manganese may present it
egrees of oxidation. If we impregnate
oth with a transparent solution of sulpl
will preserve its whiteness in drying :
ece of cotton cloth thus impregnated i
tash in a state of carbonate or of causti
ashed, be changed into a brown colour l
mospheric air. This colour will acquir
most approaching to black, upon being
me time in an alkaline oxymuriatic sol
nated alkaline liquor will assume a purpl
less transparent intensity, on leaving
nger or shorter time, some brown precip
place of a piece of cloth coloured with
ance, which therein dissolves itself, bei
id.

In general, it is proper to attend to
posing all the metallic oxides to the act
ted muriatic alkaline liquor. This, per
eans of giving them acid properties, an
me time more and more the gradual
etals. Above all, it may be remarked
f lead, which becomes gradually more
a long exposure in this oxygenated li
cessary, nevertheless, to stir it often.

The muriatic and nitro-muriatic sol

much diluted in water, have an aqueous transparency when they are well made; but when mixed together, a fine colour, like that of Malaga wine, is produced; a circumstance which could never happen, unless the oxygen of the nitro-muriatic solution united with the muriatic solution of tin. If, in a similar mixture, we pour by little and little, stirring it at the same time, the solution of gold with a great excess of acid, and diluted in 130 to 160 parts of water, the intensity of the colour of a similar mixture will increase more and more, and latterly present a very fine purple tincture, in which all sorts of stuffs may be dyed. By making the nitro-muriatic solution predominate, shades of peach flowers and lilies will be obtained; and, on the contrary, shades more or less gray are obtained by making the muriatic solution of tin predominate. Care must be taken, however, not to employ the latter in too great abundance, because, in powerfully extricating the oxygen from the oxide of gold, it will deoxidate it too much, and precipitate it. The precipitate produced in this case is not entirely deprived of oxygen, which hinders it from gilding silver in the cold, like the ashes produced from the combustion of a piece of cloth impregnated with a solution of gold. The longer or shorter preservation of the golden tincture will depend entirely upon the proportions of the two different solutions of tin, more or less overcharged with acids, and the solution of gold, in which the acid ought always greatly to predominate. In exposing the purple tincture of gold, of the most perfect transparency, to a strong heat, it will decompose itself, and precipitate the colour known by the name of purple of Cassius, the beauty of which will depend more or less on the nitro-muriatic solution of tin employed, which, mixed by itself with solution of gold, without the intervention of muriate of tin, produces no change of colour, and preserves itself a long time without forming any precipitate, if the mixture is not too much diluted with water. The purple tincture of gold is, properly, nothing else than the purple of Cassius, kept in solution by means of the oxygen of the nitro-muriatic solution of tin; and there is every reason to believe that in the purple of Cassius the oxide of gold is in some measure combined with

oxide of tin, which, giving up to it it
application to porcelain, hinders, in my
m reducing itself and regaining its n
nnot subscribe to the opinion of Dr. F
o asserts, in a memoir which I have r
thematically demonstrated that the gold
r on porcelain is in the metallic state.

The purple tincture of gold might, perh
to advantage in the dyeing of silks, a
ght be high: the colour obtained from
ner in solidity, because there is no comb
stroy it. It will be prudent, however, to
ong time in the tincture; and, to obtai
s deep, it will be necessary to repeat the
ffs more or less often, taking care to sq
d drying and shaking them between eve

The gradation of shades through which
ro-muriatic and muriatic solutions of tin
pouring into it, drop by drop, a solutio
at excess of acid, and very much dilute
ates, as I think, a gradual oxidation.
n of iron, even, appears to ascertain th
m a watery green, it acquires more an
low cast when exposed to the atmosphe
t with oxygen gas.

I have made it appear, in a memoir up
alkaline mars of Stahl, that the sulph
hyper-oxygenate itself, and lose the ex
action of light. In making a mixture
ed sulphuric acid and the nitric soluti
ned, after the evaporation of the nitri
king the residue attract the humidity o
ing it to rest a few months, crystals of
phate of iron, which I could scarcely di
heir whiteness, from sulphate of alumin
light gradually yellowed the surface:
ld be restored, however, by a slight wa
he same manner procure a sulphate of
ated, a little similar in whiteness, by pre

trate of iron, and dissolving this precipitate (sweetened, and freed from the greater part of the water), by little and little, with sulphuric acid, which ought to be concentrated, in order to obtain, without evaporation, crystals of sulphate of hyper-oxygenated iron. This salt possesses an incomparable astringency.

The operation of the transmission of oxygen appears to manifest itself the more upon pieces of linen simply dipped in acetate of iron, and maddered, since we are obliged, in order to bleach them completely, to expose them a long time in the field, if we do not choose to make use of the artificial process of bleaching. The printed parts of these pieces of cloth are often weakened, and appear sometimes as if pierced with a sharp instrument, or burned with a concentrated acid; such a circumstance could not occur, except from the action of the oxygen of the coloured oxide of iron, oxygen being successively restored to this oxidable body by the atmospheric air.

Minerals do not present the only substances which oxidate gradually, and by intermediate terms.

Indigo furnishes a proof that vegetables (and I may add also that animals) will produce similar results; for a solution of any kind of indigo (I except, however, the sulphate of indigo) may, in de oxidating or in recovering oxygen, pass through all the degrees of the shades of blueish green, even to that of a very yellow olive, and yet preserve the same quantity of indigo in solution. The beauty and solidity of the blues for dyeing, and of the blue for pencilling, depend much on the different degrees of oxidation.

XIV. *On the partial Fusion of Metals by the Electric Discharge. By a Correspondent.*

To Mr. Tilloch.

SIR,

I TAKE the liberty of sending you some further experiments and observations on the partial fusion of thin plates of metal, &c. an account of which you was so kind as to insert in your

ur Magazine of March 1805, under the
ectrical Phænomenon, communicated
nt." In these experiments, which w
th a shilling, I could not reconcile the
king place, the force employed being so
however, no doubt but this is a fusion
the piece and the coating of the phial.

Being induced to make these experime
gree of accuracy and observation, I beg
oney, as stated in my former paper: it i
metimes observed a small hole in the c
ece was taken from:" I find that this is
arge of the jar, whether the shilling is
n examining this hole (which is just
ked eye) with a microscope, I observe
usly melted, very minute globules of
ing scattered around it in every direct
hen the jar is charged very highly, an
sed, several of these holes are made,
ere is the same appearance. A small w
ssed with a brown ring, is likewise obs
g, which bears evident marks of fusion
gree than the tinfoil of the jar.

On passing twelve successive discharg
g, the surface became quite brown for
length and two lines in breadth. Th
rmanent, but easily rubbed off with the
ots, however, made at every discharge ren
be indented on the surface. It is som
at in all these experiments the effect o
ece which was next the coating of the j
le, though the tinfoil was melted as bef
her, I think, the idea of a single elect
r, this effect seems to partake more of a
tion; as the part where the discharge
s always white, though still encompass
g.

From a number of trials it appears
rcely, if at all, visible on thin plates o

have subjected them to a greater force of electricity, yet I could never discover on them any marks of fusion, or that the metal was stained brown, as in the other experiments.

It is very surprising that so small a quantity of accumulated electricity should operate so powerfully on a plate of metal, when it requires a very large battery to melt a small wire! Many electricians have turned their thoughts to the melting of wires, &c. by the electric battery, amongst whom I would notice Mr. A. Brooks, late of Norwich, who seems to have treated this subject with great perspicuity and exactness; but very few of them thought of making the discharge through *plates* of metal; which seems to open a wide field for observation and experiment.

The insertion of the above in your publication will greatly oblige, sir,

Your obedient humble servant,

C. R.

XV. *On the Reproduction of Buds.* *By* THOMAS ANDREW KNIGHT, *Esq. F.R.S. In a Letter to the Right Hon. Sir* JOSEPH BANKS, *K.B. P.R.S.*[*]

MY DEAR SIR,

EVERY tree in the ordinary course of its growth generates, in each season, those buds which expand in the succeeding spring; and the buds thus generated contain, in many instances, the whole of the leaves which appear in the following summer. But if these buds be destroyed during the winter or early part of the spring, other buds, in many species of trees, are generated, which in every respect perform the office of those which previously existed, except that they never afford fruit or blossoms. This reproduction of buds has not escaped the notice of naturalists; but it does not appear to have been ascertained by them from which, amongst the various substances of the tree, the buds derive their origin.

Du Hamel conceived that reproduced buds sprang from pre-organized germs: but the existence of such germs has

---

[*] From the *Transactions of the Royal Society* for 1805.

, in any instance, been proved ; and it is
roots, and trunk, and branches, of man
l, under proper management, afford buds
their surfaces ; and therefore, if this hyp
nded, many millions of such germs m
erated in every large tree, not one of w
ary course of nature, will come into act
e, amidst all its exuberance, does not ab
ductions, the opinions of this illustrious
his case, probably erroneous.

ther naturalists have supposed the bu
ed, to spring from the plexus of vesse
es the internal bark ; and this opinion is
ertained by modern botanists : it nevert
unfounded, as the facts I shall proce
nce.

f the fruit-stalks of the sea cale (*crambe*
near the ground in the spring, the med
hin that part of the stalk which remain
t, decays ; and a cup is thus formed, in
s in the succeeding winter. The sides
of a woody substance, which in its t
mode of generation, agrees perfectly w
rees ; and I conceive it to be as perfect
ite wood of the oak or elm : and from t
substance, within the cup, I have fr
buds to be generated in the ensuing s
ently obvious that the buds in this ca
n the bark ; but it is not equally eviden
have sprung from some remains of the
n the autumn of 1802 I discovered that
ed a similar power of reproducing its bu
this species had been set, rather late
ing, in very dry ground, where, throu
e, they vegetated very feebly ; and the p
ts remained sound and entire till the su
ng then moistened by rain, many sma
ated on the surfaces made by the kni
ts into cuttings ; and the buds of these, i

elongated into runners which gave existence to other tubers, some of which I had the pleasure to send to you.

I have in a former paper remarked, that the potatoe consists of four distinct substances, the epidermis, the true skin, the bark, and its internal substance, which from its mode of formation and subsequent office I have supposed to be alburnous: there is also in the young tubes a transparent line through the centre, which is probably its medulla. The buds and runners sprang from the substance which I conceive to be the alburnum of the root, and neither from the central part of it, nor from the surface in contact with the bark. It must, however, be admitted, that the internal substance of the potatoe corresponds more nearly with our ideas of a medullary than of an alburnous substance, and therefore this, with the preceding facts, is adduced to prove only that the reproduced buds of these plants are not generated by the cortical substance of the root: and I shall proceed to relate some experiments on the apple, and pear, and plum tree, which I conceive to prove that the reproduced buds of those plants do not spring from the medulla.

Having raised from seeds a very considerable number of plants of each of these species in 1802, I partly disengaged them from the soil in the autumn, by digging round each plant, which was then raised about two inches above its former level. A part of the mould was then removed, and the plants were cut off about an inch below the points where the seed-leaves formerly grew; and a portion of the root, about an inch long, without any bud upon it, remained exposed to the air and light. In the beginning of April I observed many small elevated points on the bark of these roots, and, removing the whole of the cortical substance, I found that the elevations were occasioned by small protuberances on the surface of the alburnum. As the spring advanced, many minute red points appeared to perforate the bark: these soon assumed the character of buds, and produced shoots in every respect similar to those which would have sprung from the organized buds of the preceding year. Whether the buds thus reproduced derived any portion of

heir component parts from the bark or no
ure to decide; but I am much disposed to
hose of the potatoe, they sprang from th
tance solely.

The space, however, in the annual ro
nedulla and the bark is very small; and
e contended that the buds in these ins
riginated from the medulla. I therefore
ary to repeat similar experiments on the
f old trees, and by these the buds were re
n the same manner as the annual root
onceiving myself to have proved in a
hat the substance which has been called t
ess does not originate from the medulla,
hat reproduced buds do not spring from t

I have remarked in a paper which you
o lay before the Royal Society in the com
resent year, that the alburnous tubes at
pwards invariably join the central vesse
essels, which appear to derive their origi
ous tubes, convey nutriment, and prob
o new buds and leaves. It is also eviden
ith which the rising sap is transferred
ounded tree to the other, that the albur
teral, as well as terminal, orifices: and
nprobable, that the lateral as well as the
e alburnous tubes may possess the pow
al vessels; which vessels evidently fee
ve existence to, the reproduced buds
erefore, as the preceding experiments a
e buds neither spring from the medulla
uch inclined to believe that they are g
essels which spring from the lateral or
ous tubes. The practicability of prop
om their leaves may seem to stand in
ypothesis; but the central vessel is al
rt of the leaf, and from it the bud and
bly originate.

---

* Phil. Trans. of 1803.

I expected to discover in seeds a similar power to regenerate their buds; for the cotyledons of these, though dissimilar in organization, execute the office of the alburnum, and contain a similar reservoir of nutriment, and at once supply the place of the alburnum and the leaf. But no experiments which I have yet been able to make, have been decisive, owing to the difficulty of ascertaining the number of buds previously existing within the seed. Few if any seeds, I have reason to believe, contain less than three buds, one only of which, except in cases of accident, germinates; and some seeds appear to contain a much greater number. The seed of the peach appears to be provided with ten or twelve leaves, each of which probably covers the rudiment of a bud, and the seeds, like the buds of the horse-chestnut, contain all the leaves and apparently all the buds of the succeeding year: and I have never been able to satisfy myself that all the buds were eradicated without having destroyed the base of the plumule, in which the power of reproducing buds probably resides, if such power exists.

Nature appears to have denied to annual and biennial plants (at least to those which have been the subjects of my experiments) the power which it has given to perennial plants to reproduce their buds; but nevertheless some biennials possess, under peculiar circumstances, a very singular resource, when all their buds have been destroyed. A turnip, bred between the English and Swedish variety, from which I had cut off the greater part of its fruit-stalks, and of which all the buds had been destroyed, remained some weeks in an apparently dormant state; after which the first seed in each pod germinated, and bursting the seed-vessel, seemed to execute the office of a bud and leaves to the parent plant, during the short remaining term of its existence, when its preternatural foliage perished with it. Whether this property be possessed by other biennial plants in common with the turnip or not, I am not at present in possession of facts to decide, not having made precisely the same experiment on any other plant.

I will take this opportunity to correct an inference that I

have drawn in a former paper[*], which
quite correctly stated) do not, on subse
the experiment, appear to justify. I hav
a perpendicular shoot of the vine was inv
ing position, and a portion of its bark b
incisions round the stem removed, mu
was generated on the lower lip of the wou
most by the inverted position of the br
opposite lip, which would not have happe
continued to grow erect; and I have infe
was produced by sap which had descen
from the leaves above. But the branch v
stated, employed as a layer, and the ma
have accumulated on the opposite lip of th
employed in the formation of roots, a c
at that time escaped my attention. The e
on the motion of the descending sap, and
of plants, are, I am well satisfied, from
experiments, very great; but it will be v
cover any method by which the extent o
be accurately ascertained, For the ves
and impel[†] the true sap, or fluid from w
appears to be generated, pass immediatel
towards the root; and though the motio
be impeded by gravitation, and it be e
into the leaf, no portion of it, unless it ha
could have descended to the part from v
aken off in the experiment I have describ
sible that in the different papers which I h
o address to you, I have drawn any ot
he facts, on repetition of the experime
apable of supporting.

I am, &c.

THOMAS

Elton,
May 12, 1805.

---

[*] Phil. Trans. of 1803.

[†] Phil.

XVI. *Proceedings of Learned Societies.*

ROYAL SOCIETY OF LONDON.

FEB. 6. The Right Honourable Sir Joseph Banks, Bart. President, in the chair. The reading of Mr. Hatchett's interesting paper on artificial tannin was resumed. *Effects of sulphuric acid on vegetables in converting them into coal.* Resins distilled yield but from ·03 to ·05 grains coal; but when treated with this acid from ·30 to ·60; with muriatic acid somewhat less. Gums, whether by distillation or digestion with acid, yielded nearly equal quantities of carbon. The author, from his numerous and very decisive experiments, proceeded with great caution to offer a theory of the formation of pit-coal; and his own discoveries have enabled him to adduce facts that seem to leave us without hope of ever attaining much more complete knowledge of the origin and formation of pit-coal than what he has modestly proposed. That all carbonaceous matter is of vegetable origin, has been generally allowed; and Mr. Hatchett thinks that the means employed by nature for converting vegetables into carbon has been by slow digestion of great masses exposed to the action of sulphuric acid. To this end he admits that muriatic acid may also have contributed; but from the much greater universality of sulphuric acid, sulphate of iron (pyrites), &c. in coals, and his synthetical experiments, which often gave 60 per cent. of carbon from vegetable matter by means of this acid, he thence concludes that sulphuric acid must have been the more efficient if not the sole agent. Carbon thus formed is found in many parts without bitumen, such as in Kilkenny and Bovey coals, &c. The bitumen is also formed of the resinous parts of vegetables subjected to the slow action of sulphuric acid.

Feb. 13. Mr. Hatchett admits that his efforts to form bitumen have not been completely successful, although there can be no doubt of its constituent principles. All synthetic experiments, he observes, are necessarily conducted too rapidly, and on too small quantities, ever to imitate effectually the process of nature. To the submarine composts or

getable solutions of certain philosophers b
erse, and appears also willing to deny th
atic acid in the formation of coal. For
as not assigned any reason, although the
ntiguity of lime to coal would tend to pr
uantity of muriatic acid been present at
ther, a new and very different substanc
roduced. The few saline springs found
al-mines, he considers as no exception t
ple of the inefficiency of muriatic acid; a
Mr. Peel may perhaps render the opin
ill more probable. Mr. Hatchett allows
ay have contributed to the formation of
ies that any fire could have been acce
equency, indeed, of numerous animal s
e limestone that is contiguous to coal
fficult to deny that animal matter could
nt at the original formation of coal.
udes this very able paper with declarin
lhering invariably to that rigid systemat
inted at in a former report, and without
at science can neither be extended nor
ses of civil society. He also recomme
the attention of other chemists, as he
ecline them for the present, and hopes
d numerous experiments may be usef
ts, and the important œconomy of fuel
the Society were ordered to this ph
ubt not that he will also receive tho
orld.

On the same evening a letter from M
esident was read, containing a brief a
worm-shell found by him in a bank o
Sumatra, after the shock of an earth
le numbers of the same species are fou
g seas, in water from one to six fathom
ngth from three to five feet, and in dia
ne inches. One of the specimens pro
ths measures above five feet, is taper,

and in other respects is somewhat different from the figure given by Rhumphius. Not one of those shells could be procured perfect in itself, but their figure may be correctly conceived from the different broken specimens. The body of the fish consisted of a gelatinous mass. The outside of the shell was white, the inside yellow, and its fracture strongly resembled stalactite.

Feb. 20. The introduction to a mathematical paper on "*Impossible* Quantities" was read, but it is impossible that we can report it.

A physiological paper, on a particular affection of the prostate gland, was also announced, the reading of which was deferred till next meeting.

BRITISH INSTITUTION FOR PROMOTING THE FINE ARTS.

The gallery belonging to this laudable institution was opened on the 17th of the present month (February) for the exhibition and sale of the productions of the British artists; and will continue open every day from 10 in the morning till 5 in the afternoon. It is but justice to say, that the display of taste, talent, and genius, which even the first opening has exhibited, are highly creditable to the British school. Many of the pictures possess the highest excellence, and all of them do honour to the individuals who have produced them.

SOCIETY OF ANTIQUARIES.

Feb. 6. Mr. Orde in the chair. Several curious historical notices were read on the character and office of the antient minstrels, or, as they were sometimes called, cytharists, in this country; from which it appeared that several females had assumed the character of wandering minstrels and dancers. Their loose manner of life soon rendered them obnoxious to the laws, and they were at length suppressed as common rogues and vagrants; but their music and dancing, we are happy to find, at no period, had any relation to the general licentiousness of persons of the like profession in every country on the continent.

Feb. 13. The right honourable president, Earl of Leicester in the chair. Mr. Lysons furnished some extracts from

e antient records of falconry, in the reig
he word *mews*, now improperly but gen
le of stables, was originally applied to a lo
gs appropriated to the *mewing* and breed
An old painting, dated 1560, with the po
Rather deathe—Then false of faythe,"
baronet, under the impression of its b
dy Jane Grey; but which might be more
er, as supposed by the secretary, the
his circumstance should teach amateurs
lous in purchasing old paintings.

ROYAL JENNERIAN SOCIE

At a special meeting of the board of dir
the central house of the society, No. 14,
eet-street, the following report of the m
e subject of vaccine inoculation, wa
ard.

REPORT.

The medical council of the Royal J
ving been informed that various cases ha
cited prejudices against vaccine inocul
check the progress of that important
gdom, appointed a committee of tw
mbers to inquire, not only into the n
h cases, but also into the evidence re
small-pox, alleged to have occurred
son.

In consequence of this reference, the
igent inquiry into the history of a nu
ich it was supposed that vaccination ha
small-pox, and also of such cases of
ted to have happened subsequently
culated small-pox.

In the course of their examination the c
t opinions and assertions had been a
ated, which charged the cow-pox with
ble to particular diseases, frightful in
l hitherto unknown; and judging su

connected with the question as to the efficacy of the practice, they thought it incumbent upon them to examine also into the validity of these injurious statements respecting vaccination.

After a very minute investigation of these subjects, the result of their inquiries has been submitted to the medical council; and from the report of the committee it appears:

I. That most of the cases, which have been brought forward as instances of the failure of vaccination to prevent the small-pox, and which have been the subjects of public attention and conversation, are either wholly unfounded or grossly misrepresented.

II. That some of the cases are now allowed, by the very persons who first related them, to have been erroneously stated.

III. That the statements of such of those cases as are published, have, for the most part, been carefully investigated, ably discussed, and fully refuted, by different writers on the subject.

IV. That notwithstanding the most incontestable proofs of such misrepresentations, a few medical men have persisted in repeatedly bringing the same unfounded and refuted reports and misrepresentations before the public; thus perversely and disingenuously labouring to excite prejudices against vaccination.

V. That in some printed accounts adverse to vaccination, in which the writers had no authenticated facts to support the opinions they advanced, nor any reasonable arguments to maintain them, the subject has been treated with indecent and disgusting levity; as if the good or evil of society were fit objects for sarcasm and ridicule.

VI. That when the practice of vaccination was first introduced and recommended by Dr. Jenner, many persons, who had never seen the effects of the vaccine fluid on the human system, who were almost wholly unacquainted with the history of vaccination, the characteristic marks of the genuine vesicle, and the cautions necessary to be observed in the management of it, and were therefore incompetent to

cide whether patients were properly va
vertheless ventured to inoculate for the c

VII. That many persons have been decl
ted, when the operation was performed
nt and unskilful manner, and when the i
terwards see the patients, and therefore c
hether infection had taken place or not ;
use are certainly to be attributed many
ced in proof of the inefficacy of cow-po

VIII. That some cases have been br
mmittee, on which they could form no
om the want of necessary information as
the preceding vaccination, or the reality
pearance of the small-pox.

IX. That it is admitted by the comm
ses have been brought before them, of p
all-pox, who had apparently passed thr
a regular way.

X. That cases, supported by evidenc
ve been also brought before them, of p
ving once regularly passed through the
inoculation or natural infection, have
cond time.

XI. That in many cases in which
curred a second time, after inoculation
se, such recurrence has been particularl
al; whereas, when it has appeared to
tion, the disease has generally been s
me of its characteristic marks, and e
nder its existence doubtful.

XII. That it is a fact well ascertained,
ular states of certain constitutions, w
riolous matter be employed, a local
excited by inoculation, the constituti
ected; yet that matter taken from su
riolous pustule is capable of producing
t disease.

XIII. That if a person, bearing the

indubitable marks of having had the small-pox, be repeatedly inoculated for that disease, a pustule may be produced, the matter of which will communicate the disease to those who have not been previously infected.

XIV. That although it is difficult to determine precisely the number of exceptions to the practice, the medical council are fully convinced that the failure of vaccination, as a preventive of the small-pox, is a very rare occurrence.

XV. That of the immense number who have been vaccinated in the army and navy, in different parts of the united kingdom, and in every quarter of the globe, scarcely any instances of such failure have been reported to the committee but those which are said to have occurred in the metropolis or its vicinity.

XVI. That the medical council are fully assured, that in very many places in which the small-pox raged with great violence, the disease has been speedily and effectually arrested in its progress, and in some populous cities wholly exterminated, by the practice of vaccination.

XVII. That the practice of inoculation for the small-pox, on its first introduction into this country, was opposed and very much retarded, in consequence of misrepresentations and arguments drawn from assumed facts, and of miscarriages arising from the want of correct information, similar to those now brought forward against vaccination, so that nearly fifty years elapsed before small-pox inoculation was fully established.

XVIII. That by a reference to the bills of mortality, it will appear that, to the unfortunate neglect of vaccination, and to the prejudices raised against it, we may in a great measure attribute the loss of nearly two thousand lives by the small-pox, in this metropolis alone, within the present year.

XIX. That the few instances of failure, either in the inoculation of the cow-pox, or of the small-pox, ought not to be considered as objections to either practice, but merely as deviations from the ordinary course of nature.

XX. That if a comparison be made between the preservative effects of vaccination, and those of inoculation for the

all-pox, it would be necessary to take i
ater number of persons who have been v
iven time: as it is probable that, withi
rs, nearly as many persons have been in
v-pox as were ever inoculated for the sm
ctice was introduced into this kingdom.

XXI. That from all the facts which the
collect, it appears to the medical counc
x is generally mild and harmless in its
few cases which have been alleged ag
y be fairly attributed to peculiarities of c

XXII. That many well-known cutane
ne scrophulous complaints, have been
ects of vaccine inoculation, when in fa
m other causes, and in many instanc
er vaccination; and that such diseases
quent after vaccination, than after eith
culated small-pox.

Having stated these facts, and made th
medical council cannot conclude the
bject so highly important and interestin
community, without making this sole
That, in their opinion, founded on the
perience, and the information which th
collect from that of others, mankind ha
at and incalculable benefit from the di
ion; and that it is their full belief, that
tations of advantage and security which
m the inoculation of the cow-pox, will
mpletely fulfilled.

(Signed)

Ed. Jenner, M.D. president.
J. C. Lettsom, M. D. V. P.
John Ring, V. P.
Joseph Adams, M. D.
John Addington.
C. R. Aikin.
Wm. Babington, M. D.
M. Baillie, M. D.

W. Bla
Gil. Bl
Isaac B
Wm. C
John C
Astley
Wm. I
Richard

Tho. Denman, M. D.
John Dimsdale.
Henry Field.
Edward Ford.
Joseph Fox.
Will. M. Fraser, M. D.
William Gaitskell.
Wm. Hamilton, M. D.
John Hingeston.
Everard Home.
Robert Hooper, M. D.
Joseph Hurlock.
John Jones.
Thomas Key.
Francis Knight.
E. Leese.
L. Leese.
William Lewis.
William Lister, M. D.
Alex. Marcet, M. D.
Joseph Hart Myers, M. D.
James Parkinson.
Thomas Paytherus.
John Pearson.
George Rees, M. D.
John Gibbs Ridout.
J. Squire, M. D.
James Upton.
J. Christian Wachsell.
Thomas Walshman, M. D.
Robert Willan, M. D.
Allen Williams.
James Wilson.
J. Yelloly, M. D.

John Walker,
Secretary to the council.

January 2, 1806.

ACADEMY OF USEFUL SCIENCES AT ERFURT.

Professor Bernardi is returned to Erfurt from his five months tour through the Carinthian Alps. Notwithstanding the difficulties he had to encounter from unfavourable weather and the operations of the war, he has no reasons to be dissatisfied with the result of his journey. He has made a number of new discoveries which he is about to publish. In an essay read before the academy, on the 2d of December, he says: "It surely cannot be supposed that our country has been yet sufficiently examined. In the southern part of it, in particular, there are many hidden treasures of science; and it is incontestably a great error in our countrymen to travel into foreign countries, forgetting the treasures of which Germany has to boast." The first proof which the professor exhibited of this fact was by the communication of two kinds of the herb Speedwell or Fluellin, not yet hitherto sufficiently well described, and which nearly resemble the *Veronica spicata*. The one he calls *Veronica cristata*,

tata, and the other *Veronica sternbergia* ch he found in Hungary near the G on the mountains of Dornach not f ers very little from the *Veronica spicat* stalk and leaves, but much more in t stalk of the flower. It carries its bloss The folds of the flowers, which resem not so broad; they are rolled together to do not present a genuine pipe; so that th nnel-like appearance, and approaches k to that of the *Veronica sibirica* an ect to other particulars it does not d n the *Veronica spicata*, which is alrea bed. In the botanical system it has th eristic—Ver. spica terminali, corollæ su tice convolutis, falcis oppositis.—The unt Sternberg already remarked in Italy in and gave it the name of *Ver. glabra*. Bu de use of this name to another kind of V ught proper to name it after its discover ws at Krain, near Jauernberg, on the hill foot of Belsbiza. Its stalks and leaves a less; the first is very lank, and its lon s stand somewhat crowded together nized by the following difference—V. r ollæ rotatæ, laciniis patentibus, foliis o oris.—Professor Bernardi has more clea btful Speedwells or Fluellins—V. urti crium, prostrata et pilosa, and has assig descriptions. This essay of Professor r in the acts of the academy, a new be immediately published.

ACADEMY OF SCIENCES, GOTT

This academy has added the names of Ch h members of the National Institute of heir foreign associates.

XVII. *Intelligence and Miscellaneous Articles.*

PRODUCTION OF MURIATES BY THE GALVANIC DECOMPOSITION OF WATER.

To Mr. Tilloch.

SIR, Leicester, Feb. 15, 1806.

I HAVE the pleasure to inform you I have tried Mr. Peel's experiments relative to the formation of muriat of soda and muriat of potash, which were in your Magazine in April and July last, and find them to be perfectly correct.

Yours truly, &c. &c.
A. B. HORTENTZ.

BEET-ROOT SUGAR.

A manufactory for this sugar has been established by a company of merchants in the neighbourhood of Moscow; and the success of the establishment has proved, that from this vegetable a sugar is obtained which not only finds a ready market, but which, the consumers say, yields in no quality whatever to the sugar generally in use.

A specimen has been presented to his majesty the emperor of Russia, who was pleased to express his high satisfaction with it.

CURE FOR DROPSY.

We have already had occasion to announce, that different people who had been afflicted with dropsy, had been perfectly cured by means of Bohea tea. In the Greenock Advertiser we find the following instance of the efficacy of this remedy:

A correspondent in Islay requests us to state, for the information of the public, that Donald Cameron, a herd upon the farm of Machry, in that island, was severely afflicted with a dropsy, which kept him bed-fast from July to November last; but was finally cured by using a quarter of a pound of Bohea, drinking a strong infusion of it, and eating the leaves. In three days the immense quantity of water that was in his body disappeared, the tea having acted as a powerful diuretic; and he is now stout and hearty,

er being despaired of and given over by
t saw him.

CURE FOR DEAFNESS.

Petersb

Demetri Simeonovitsch Sitnikoff, a merc
s for half a year deprived of the faculty
the remedies usually prescribed for that
hout effect. At last he had recourse
ple operation: After having filled his
oke of tobacco, he closed it firmly, a
reby forcing the smoke to find its way
e following morning he felt a crash, firs
n in the other, and from that momen
n completely restored.—*Hamburgh Corr*
ary 8.

FOSSIL SKELETON.

At Sir Joseph Banks's conversationi on th
— Hawker, esq. of Dudbridge, Glouc
d complete drawings, and several of th
ile animal similar to a crocodile, found i
imestone 20 feet thick. It was imbedd
surface of the stratum. The skeleton n
ength, and all the parts are wonderfull
s which were exhibited contained the t
ation, and still covered with the enamel
ch was broken had so exactly the frac
ed petrified wood, that it would have d
e mineralogist, and furnishes a strong
that many fossils generally held to be
nimal origin. In the same stratum of lin
y cornua ammoniæ, mussels, and other

HOLBEIN'S DANCE OF DEAT

is well known that Basil in Switzerlan
Holbein's celebrated picture of the D
ch had undergone several repairs from ti
been recently retouched, to the great sa
connoisseurs. In the evening of the 6t
ever, a mob collected in Basil, and, ac

great number of women carrying lanthorns, broke in upon the gallery in the church-yard, which contained this masterpiece of antiquity, tore it from the walls, and in a few minutes succeeded in completely destroying it !

FALLING BODIES.

Mr. Benzenberg, professor of physic and astronomy at Dusseldorf, has published an account of twenty-eight experiments made in the coal mines of Schebusch with balls well turned and polished. They were made to fall from a height of 262 French feet. At a medium they produced a deviation of five lines towards the east: the theory gives 4·6 lines. These experiments furnish an additional proof, if any were wanted, of the rotary motion of the earth. Experiments made at Bologna by Mr. Guglielmini gave nearly the same results.

PROGRESS OF LITERATURE IN RUSSIA.

In the year 1804, fifteen new journals were printed in Russia, and 115 new books were published the same year at St. Petersburg and Moscow: among the latter were translations into the Russian language of the following works—Sterne's Tristram Shandy; Rousseau's Confessions, and his Eloisa; Hufeland's Art of prolonging Human Life; Barthelemy's Travels of Anacharsis; besides a variety of original works in the Russian language.

RUSSIAN EMBASSIES TO PEKIN AND JAPAN.

Petersburgh, Jan. 18.

Several persons who were appointed to travel with the embassy to Pekin have returned from Irkuzk, and have already arrived here. The counsellor of state, Fosse, who accompanied the chamberlain Resanow on the embassy to Japan, has also arrived here from Kamtschatka. After a stay of seven months, the embassy left Japan and returned to Kamtschatka in the Naveschda, a vessel commanded by captain Krusenstiern. Chamberlain Resanow set out from thence to Kodiak, and the other possessions of the Russian American company, according to his instructions, after having dispatched counsellor Fosse here by the way of Ochozk. Captain Krusensteirn sailed with the rest of the embassy for Canton,

nton, their original destination, whence
ey will return next August. As far as w
nt had befallen the embassy, all the m
re in good health. The Naveschda lef
middle of June.

LIST OF PATENTS FOR NEW INVE

To William Sampson, of Liverpool, i
neaster, wheelwright; for certain impr
plication of power employed mechanic
apted to the use of cranks, and fly wh
vances producing equivalent or similar e
uary 12, 1806.

To John Phillips, of East Stonehouse,
evon, stonemason and sculptor; for im
nstruction of tinder-boxes. Dated Febr

To John Phillips, of East Stonehouse,
evon, stonemason and sculptor; for a ch
straight, square, and parallel stone an
hich chain may be applied to other useful
bruary 12.

To John Marshall, of Northwick, in th
Chester, salt proprietor; and John Na
the same county, salt proprietor; for a
thod or manner of manufacturing and m
bruary 14.

To Thomas Kentish, of Baker-street, N
Saint Marylebone, in the county of Mi
tain improvements in the construction o
es applicable to the moving, raising, or
lies and weights of all kinds, either
rd of ships and vessels. Dated Februa

To John Woodhouse, of the parish of
nty of Northampton, engineer; for cert
ative to canals. Dated February 20.

To John Jones the younger, of Birmingh
Warwick, tool-maker and die-sinker;
the mode of manufacturing barrels for
bruary 20.

METEOROLOGY.

Monthly recapitulation of meteorological observations made at the forest four miles east of the river Mississippi, in latitude 31° 28″ north, and in longitude 91° 30″ west of Greenwich, for the year 1800. By William Dunbar, esq.

Year 1800.	THERMOMETER.			BAROMETER.			RAIN.
	Greatest Height.	Least Height.	Mean Height.	Greatest Height.	Least Height.	Mean Height.	Total.
	Deg.	Deg.	Deg.	Inches.	Inches.	Inches.	Inches.
January	68	21½	43½	30·05	29·60	29·90	1·32
February	72	25	42½	30·10	29·52	30·02	3·11
March	78	28	58½	30·00	29·38	29·78	1·53
April	85	44	66¼	30·07	29·65	29·84	6·92
May	90½	61	72	29·95	29·62	29·76	3·94
June	96	61	79½	29·99	29·61	29·80	1·26
July	96	63	81½	29·99	29·78	29·90	4·83
August	96	70	82	29·99	29·71	29·86	0·35
September	90	59	76½	29·99	29·71	29·83	4·40
October	87	36	66	30·29	29·78	30·19	0·40
November	79	22	56	30·43	29·91	30·13	0·03
December	75	12	47¼	30·30	29·74	30·05	3·00
Whole Year	96	12	64¼	30·45	29·38	29·92	31·09

Mr. Dunbar's general observations on each month say, The month of May is the most agreeably temperate, and one of the driest; but the present is an exception to the rule.

METEOROLOGICAL TABLE,

By Mr. Carey, of the Str

For February 1806.

ays of the Month.	Thermometer.			Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.
	8 o'Clock, Morning.	Noon.	11 o'Clock, Night.		
Jan. 27	33°	39°	34°	29·10	5°
28	34	36	34	·10	4
29	34	36	34	·15	0
30	28	34	33	·15	5
31	28	37	30	·54	10
Feb. 1	28	42	31	·84	16
2	31	37	32	·90	0
3	32	35	31	·62	7
4	33	37	35	·62	0
5	46	53	47	·64	18
6	41	47	46	·70	9
7	45	53	46	·60	24
8	44	52	46	·80	20
9	44	47	40	·59	0
10	40	48	39	·73	15
11	37	47	41	·82	10
12	37	44	39	·84	26
13	40	44	32	·69	15
14	33	41	36	·40	0
15	37	42	37	·56	0
16	38	44	37	·84	7
17	36	47	35	30·00	21
18	35	42	31	·20	15
19	38	43	39	·23	15
20	39	43	40	29·95	10
21	41	50	45	·83	7
22	46	52	40	·61	10
23	42	50	44	·80	12
24	44	55	48	30·20	22
25	46	54	47	·22	15

N. B. The barometer's height is taken

XVIII. *On the Possibility of naturalizing the Cachemire Goat of India to the Climate of Europe: in a Letter from Dr.* De Carro, *of Vienna, to Professor* Pictet, *of Geneva**.

Vienna, July 3, 1805.

You remember, sir, undoubtedly, the project which I communicated of profiting by the complaisance of numerous correspondents whom I have in different parts of Asia, and of the obligations which they acknowledge they owe to me for having furnished them with the means of propagating vaccination through a great part of the East. You know that my principal aim was to direct their attention to the alimentary plants of Asia, the culture of which might be useful in Europe. Of such plants I have continually solicited the seeds, with instructions for the necessary culture, relying at all times in this search on the information of the learned Dr. Roxburgh, manager of the botanic garden at Calcutta. I have also had recourse to you, sir, in requesting your suggestions on those objects which might be particularly useful to our country. You have thought of mountain rice. I have asked it from my correspondents; and, in spite of the small hopes of success which your experiments have hitherto afforded me, I shall still submit to your care and experiments the specimens of such articles as I receive from the East. You have, among other things, enjoined me to consider if means could be used to bring to Constantinople a pair of those famous goats of which the wool is manufactured into those beautiful and costly Cachemire shawls, so much in fashion throughout Europe and Asia.

Considering the difficulties of such an enterprise, it is proper to cite, perhaps, the very passage of your letter of the 21st of March 1805:—"Do you believe it possible to bring to Constantinople a pair of shawl goats? The English have not succeeded in naturalizing this Indian animal to their own climate. A single goat was brought to England, but

---

* From *Bibliotheque Britannique*, vol. xxix.

t died almost immediately on its arriv
wever, may have been made witho
y experience in sheep makes me unw
the impossibility of naturalizing a
ate. But it is an enterprise for a prin
at must be brought from the mountai
ere would be many difficulties to surmou
ecimen. It is a problem which I subm
on." Judging, as you do, that the diff
ats from Thibet would be in fact ins
out obtaining information if there was
onstantinople to which this animal was
as my object in a note which I sent on t
Mr. Wallenbourgh, who passed many
ple when employed in the Imperial le
e state chancery at Vienna, and who is
nguages and commercial affairs of the
odness to communicate to me the a
ived, and to allow me to make what
it.

"Mr. Cogiasar de Sophialy to Mr.

"Although during my stay of some
sied myself in collecting all possible inf
g the manufacture of Cachemire shawls,
possible, to obtain some further inform
erchant lately arrived here, that I migh
ceived from you. The animals whose
achemire shawls are not goats, but she
ance of 305 conaks (days' journeys) b
ins where they are found, and Bagdad.
rving a couple of pairs of those sheep,
ry to make a purchase of twenty pairs
e change of climate, and the length of
ry dangerous to them. It would be n
confidential person to make this purcha
e animals hither; and he could scarcely
ve years, owing to the mode of trav
nown that these journeys are made w

mels; and the same camels that leave this place do not go on to Bagdad, these caravans being bound only from one town to another; so that he is often obliged to wait on his journey till another caravan is ready to set off. The khans or chieftains of these countries are also frequently at war with each other; and the traveller may be sometimes shut up six months, or a year, in some town, from which he dares not attempt to stir.—Such are the reasons of the journey being so tedious.

"It is impossible to bring the sheep in question in any other way than by these caravans of camels, by putting a pair in panniers upon each camel. This would cost at least 1500 piastres for the hire of the camels; besides, at least, 1500 more, to pay the confidential person employed to purchase and convey them: and besides all this, it would be still necessary to hire three or four persons to take charge of those animals during a long journey.

"It is questionable, however, how far one could count on the fidelity of this description of people; for they are often tempted by the love of gain, instead of fulfilling their commission, to stop in those distant countries, where one can only hear of them once a year, and speculate with the money which has been advanced to them. We have experienced this ourselves. Twelve years ago we intrusted 50,000 piastres to a factor who went to get shawls manufactured for us at Cachemire; and we are still waiting his return: in the mean time he is amusing himself with speculations at our expense.

"Thus, setting aside these inconveniences, it would be necessary to calculate on an expense of more than 50,000 piastres, without the certainty, even if the object were attained, of saving a couple of pairs of the sheep. Their food is herbage; but, as they have to pass through deserts, it would be necessary to have always sufficient quantities in store; and this would require still more camels for its carriage, which must, of course, augment the expense.

"If the person who desires to have two or three pairs of these animals, wishes them as curiosities, he must risk 50,000 piastres; but if it be for the purpose of multiplying

breed in Europe, and obtaining their fle
acture of shawls like those of Cachemir
ld succeed at all. The change of climate
redly deteriorate the fleece. Besides,
it would be impossible to imitate the sh
e. Their goodness, their elasticity, the li
urs, are owing to the water of the rive
ugh the city; and the same shawls, whe
e river fifteen miles further down, do
e good qualities: the difference is inc
to the feeling and sight. It would b
to bestow so much expense on this obje
Such, sir, is the best information I c
subject of your inquiries; I am sorry
e more favourable. With respect, I am
" (Signed) COGIASAR D

ll these details justify the opinion you h
great difficulty of the enterprise. It
as a government, or a rich company
pt. If such information could be t
ld rejoice to have communicated it.

he authority of some travellers, in som
liotheque Britannique, that the animal
: according to the preceding letter it is
the right? If it be Mr. Cogiasar de S
, sir, a great encouragement to continu
amelioration of wools, and the imitati
e shawls.

Observations of M. Pictet on the prece

is in the valleys and on the mountain
the animal lives which furnishes mate
acture of Cachemire shawls. The dista
ney eastward from Cachemire to the
found. (See Forster's Travels in Cach
tled to call this animal by the name of

Mr. Cogiasar de Sophialy is, according to Mr. De
greatest merchants of Constantinople, an Armeni
skilful person in commercial matters to whom he
elf.

thority of a passage taken from Turner's Relation of an Embassy to Thibet, published in 1800. The English ambassador had passed the Bootan and approached *Teshoo Lamboo,* the residence of the lama, in the 28th degree of north latitude, before he saw any herds of those precious animals.

"The shawl goats feed in numerous herds on the short and scanty herbage which scarcely covers those elevated places. This animal is, perhaps, the most beautiful of all those that compose the numerous family of the goat kind. Their colour varies much. Some are black, some white, some blueish, and others of a tint a little lighter than that of a young fawn. This goat has straight horns, and is shorter in height than the smallest English sheep. The matter employed for the fabrication of shawls is a fine down which lies close to the skin. A long coarse hair covers this down, and serves to preserve its softness."

Forster, who carefully examined the valley of Cachemire, calls the matter of which these shawls are made wool. But he never saw the animal; and this expression no more proves its being the production of a sheep, than the term *vigonia* wool proves that the vigon is not of the goat kind. We know that the camel, the paca, the glama, the vigon, the goat of Tauris, and one of the varieties of the goats of Syria, yield, under the long and coarse hair, a down more or less fine. It is true that there are races of sheep, such as those of Shetland, those of Iceland, and some parts of Siberia and Tartary, which have in like manner a fine and soft down under their rough wool. Thus, the animal of Thibet which produces the precious matter of the shawls may, perhaps, be a sheep. By its dimensions it should belong rather to the sheep than the goat race, and it would not be astonishing that travellers should have made some mistake. Samuel Turner inspires confidence in his observations respecting natural history. He appears accurate in all the details relating to his mission. He describes distinctly all the animals of those high regions, and, in particular, the sheep of the country. The manner in which he speaks of the flocks of shawl goats leaves no room to doubt that he has examined

se animals minutely. The word *goat*, wh
o are best acquainted with those coun
animal, is a strong indication that it
ce they would have called them shawl
wn the characters belonging to that race
The important point, however, is not it
heep, but whether it can be transported
the climate of Europe. When we gave ou
f in joke, half in earnest, the problem t
air of those goats could be brought to C
ught of the possibility of bringing them
ns of Lesser Thibet, near the country of
ere the analogy of climate seems to i
ld live equally well. From the mou
ibet the river Giluma runs into the C
igation of this river from Badacian t
gues; and the navigation of the Caspia
Feorabath or to Terki, is about 200 leag
uld remain the passage by land to Trebis
, or by the route to the mouth of this r
ll known, formerly served for transpor
m India.

The letter of our friend's correspondent
ggerated idea of the real difficulties of
mal; but the greatest difficulties migh
per regimen for their preservation in F
highest country of the old continent, an
nly dry during the season which is not
son, *i. e.* from October to June or J
the pastures grows brown and dry, so a
to powder when touched. It is this
nty in quantity, but apparently contain
stance in small volume, which is the
the shawl goats. Could the animal su
lar nourishment? Would it be possib
ne grass in some parts of the Pyrenees
not necessary for the animal to have
te, and a soil extremely dry? If it co
mate, would it retain the down which

the cold? or would this down preserve its softness, its fineness, its strength and elasticity, which constitute its value?

As to the secret virtue of the river which runs by Cachemire, and which it loses further down, it may perhaps be of that kind of virtue which was attributed exclusively to the little river of the Gobelins. In all countries, the people who have brought any process of art to perfection are interested in throwing a mystery over the operations to which they owe their success. If this idea of obtaining the shawl goats to Europe be not chimerical, it is for France to realize it, since it possesses the greatest variety of climates.—Our readers will judge by this specimen of the benevolent activity of Dr. De Carro, whose success in propagating vaccination has only increased his zeal for the advancement of useful knowledge.

XIX. *An Essay on the Theory of mixed Gases, and the State of Water in the Atmosphere. By Mr.* JOHN GOUGH *.

FOUR essays appear in the fifth volume of the Memoirs of the Literary and Philosophical Society of Manchester, which contain many new ideas relating to the constitution of mixed gases, and the state of water in the atmosphere. The design of these papers is evidently intended to remove certain difficulties which must strike every man of science who happens to peruse M. de Luc's theory of atmospherical vapour. This attempt has the double recommendation of ingenuity and novelty; but the leading opinions of the system, even in its present form, are liable to several objections, which I am going to point out, being generously invited to undertake the task by the author himself. My doubts relative to the subject arise partly from mathematical considerations, and in part from the evidence of experiment. Certain objections of the first class dispose me to conclude, that an atmosphere constructed on Mr. Dalton's plan will appear upon examination to be repugnant to the principles of the mechanical philosophy; and a direct appeal to experiment has moreover con-

---

* From *Manchester Transactions*, second series, vol. i.

nced me that well established facts contr
ints of the theory.

To begin with the objections of the f
ady to admit the existence of a fluid mi
d described at page 543, in the fifth vo
ester Memoirs, with this reservation, t
made merely for the purpose of showin
on to be incompatible with the usual co
moment; which being demonstrated, t
ndamental hypothesis will follow, as
ence. To give a concise view of M
tion of the subject, we are to suppo
inct gases to be confined in a space con
hich space may be circumscribed by t
a vessel, or the compressing power of
sides this, we must imagine the cons
ch individual gas to be actuated by a
hile at the same time they remain per
e particles which compose the other
ed in the common space: in short,
at the particles of each gas act upon
nd in the manner of elastic bodies, but
ws of inelastic bodies as often as they
scles of a different denomination. A
eceding particulars, we may conceive
ent of the elementary parts of a fluid
e adjustment of the whole shall be of a
ll form, from particles of any one deno
neous fluid possessing its own separate
quently each gas will exist as an indep
ercise the functions of its elasticity jus
ids were withdrawn from the common
natic arrangement in an assemblage of
nnot be maintained unless one particul
sing its component parts be observed,
at distribution of the elements which wi
e equilibrium in the fluid composed
rpuscles of each denomination; conse
rium in question cannot take place un

disposition of the heterogeneous particles be first established; so that the former requisite of the theory is entirely dependent on the latter. After having acquired a distinct idea of a fluid mixture, composed of gases possessing separate equilibria, we come in the next place to investigate the mechanical properties of such a compound; in the prosecution of which inquiry the comparative densities of the constituent fluids must be first determined in a horizontal plane, the situation of which is given in the common space.

Let the figure PMINKV (Plate I. fig. 2.*) represent this space, in which MVNK is the given plane. Now since every point of this plane may be supposed to be at an equal distance from the earth's centre, the density of every homogeneous gas supported by it will be the same in all parts of it. Let the constituent fluids be denominated A and B; also let C denote the compound; moreover let the densities of A and B, at P, be p and q; let PX and XY be two equal evanescent parts of the line PV. Now, seeing the pressure acting upon an elastic fluid is as the density of it, the fluxionary increments of p and q are as these quantities; but the densities of A and B, in the point X, are equal to the sums of p and q united to their increments respectively: let these sums be called e and f; then e is to f as p is to q, by composition of proportion: in like manner we find the density of A at Y to be to that of B at the same point as e is to f; *i. e.* as p is to q; thence it follows, that the fluxionary increments of the two densities have universally the given ratio of p to q; consequently the contemporary fluents, or the densities themselves, have the same given ratio: now what has been proved of the two gases A and B may be extended to any other number, viz. the ratios of their densities on the same horizontal plane will be given.

The ratio of A, B, &c. being found to be constant, we can proceed to investigate the proportions of the quantities of matter contained in these fluids. Let D and d be the densities of A and B in the plane MKNV; also let W and w be the quantities of matter of each kind contained in the variable space PMKNV; call PV x, and the area of the plane

---

* Given in our last number.

ne MKNV *y*: now the fluxion of the
xpressed by *y* into the fluxion of *x*; m
es of matter in two solids are in the co
ir magnitudes and densities, or in that
ly, if their magnitudes be equal; theref
is to that of *w* as D is to *d*, because the
ude is common both to W and *w*; b
, a constant ratio; consequently fluxion
w as *p* is to *q*; therefore W has to *w* the
t is, the matter in A is to the matter i
the next place let R and *r* be the distan
gravity of A and B, from the point
e PI: then R into the fluxion of W is
ct of D, Y, *x*, and the fluxion of *x*, fr
orem in mechanics; for the same reason
w is equal to the product of *d*, *y*, *x*, and
nto fluxion of W is to *r* into fluxion o
t D is to *d* as fluxion of W is to fluxio
l *r* are equal: consequently the centres
le, and the point of their coincidence
the system C. Thus it appears, that
nt gases of a fluid mixture possess separa
nsities are every where in a given ratio,
mmon centre of gravity: the converse o
e, viz. if their densities be not every
io, and if they have not a common cent
not possess separate equilibria.

It is necessary to observe in this stage o
ugh we admit the particles of A and B
ation to each other, the concession mu
ed to the particles themselves; for the
mposed of them are elastic bodies; the
l communicate motion according to th
culiar to bodies of this description. T
ties of a fluid mixture, which has bee
ly adjusted, are now to be used in the e
ndamental proposition of the new theor
in the constitution of the atmosphere.
position, if two gases come into conta

which are perfectly inelastic in respect of each other, the particles of A meeting with no repulsion from those of B further than that repulsion, which as obstacles in the way they may exert, would instantly recede from each other as far as possible in their circumstances, and consequently arrange themselves just as in a void space. The preceding are the words of the author of the theory; and it is readily granted that the particles of such a heterogeneous mixture would recede from each other as far as circumstances will permit; the present subject of inquiry, then, brings the dispute to this issue—Can that arrangement take place amongst the particles of two or more gases, which will make their centres of gravity coincide in one point? For the separate equilibria of the fluids which enter into the constitution of the compound, will not be established until this arrangement be perfectly formed. The completion of this process being essential to the new theory, the effect of it has been, perhaps, too hastily inferred in the fourth proposition of Mr. Dalton's first essay; for I am sorry to observe that the inference is not supported by demonstration drawn from the doctrine of mechanics. It is the business of the present essay to supply what has been omitted, and to investigate the consequences which must arise from the collision of two heterogeneous gases differing in their specific gravities.

The existence of the fluid mixture, required by the theory, has been granted already for the sake of argument; and in order to continue the inquiry it must be remarked at present, that the necessary internal arrangement of the compound C, is liable to be disturbed perpetually by accidents resulting from the course of things; to which course the author of the theory undoubtedly wishes to accommodate his ideas. The preceding assertion may be exemplified in a manner which is familiar, and may be applied with ease to natural phænomena: let us suppose, then, an additional quantity of the gas A to be thrown into the pneumatic apparatus containing the compound C, which was in a state of proper adjustment previous to this event. No one will imagine that this fresh matter can diffuse itself through the mass of C with the same expedition that the electric fluid shows in

expanding along a conductor: this sup
cted by various appearances, from which
selected,—agitation is known to accel
ygen and nitrous gas. The quantity
s been newly admitted, will remain at
; but it will act immediately with a re
ndred particles diffused through the co
w modification of A will not preserve
rts every where in a constant ratio to
rresponding parts of B; and this chang
ntres of gravity of A and B, which has
at when these points are placed apart,
oria of the fluids cease to exist, which
onstrated before: therefore A and B b
t mutually; which circumstance distu
justment of C, and forces it to assume
has also been proved in a former parag
uids will act upon each other in the mann
en when the heterogeneous particles
utually inelastic; consequently A and B
e law of their specific gravities as soon
avity are separated by introducing into
C, a fresh quantity of A or B: in c
teration the centre of gravity of the heav
descend, while that of the lighter move
ce the centres of two gases are placed
on will become permanent; because, w
ey are urged in opposite directions b
om the difference of the specific weights
d this contrariety of efforts must conti
o centres are disjoined; consequently
rce must be lasting, seeing nothing ca
it an union, which it will always prev
utual repulsion of the constituent par
onsidered apart, in any manner promot
e centres of gravity of the two fluids,
d re-action of a number of bodies amo
ot alter the state of their common centr
er it be at rest or in motion: so that

the necessity of observing the law of their specific gravities, just as if the kindred particles of each fluid were actuated by no reciprocal repulsion nor any other cause of re-action. The doctrine of gases, which are mutually inelastic, is rendered indefensible by the preceding arguments; for the hypothesis is thereby exposed to a difficulty which, the author of the theory justly remarks, makes a mixture of mutually repulsive gases of different specific gravities an improbable conjecture; so that his own objection ultimately discountenances the leading opinions of that theory which it induced him to adopt in particular. At the same time philosophers are convinced that the atmosphere is a compound of gases possessing various degrees of specific weight; they moreover know that different chemical agents perpetually disturb the equilibrium of the compound, as some of them constantly absorb while others unfold the gases of which it is composed. The preceding facts are certain; consequently the heterogeneous elements of the atmosphere must be united by a common tie, which may be denominated a species of affinity, at least while our knowledge of the subject remains in its present imperfect state. The transparency of the great body of air surrounding the earth, also affords a strong argument for the chemical union of its component fluids, and at the same time discountenances the idea of the compound being a mechanical mixture of any description whatever; for when a number of diaphanous bodies of different specific gravities are mixed together, they form an aggregate which is opaque; but the union of the substances by fusion renders the mass transparent in many instances. Now, as the atmosphere is diaphanous, we are obliged, by the principles of sound argument, to consider it in the light of a compound, the ingredients of which are united by a chemical tie. Whatever may be the condition of the elastic fluids which enter into the composition of common air, one thing is certain, from a preceding paragraph of this essay, namely, no one of them can maintain a separate equilibrium as long as it makes an individual of the aggregate; consequently each particle of the compound must be urged by a force re-

sulting from the general action of the n
sure occasioned by a particular member

On this account it is impossible for
common air to preserve the character of
ratures, because steam cannot support 3
unless it is heated to 212 degrees of F
meter: were it then practicable to mix
with atmospherical air, the spring of the
it in an instant to the state of a liquid;
which renders De Luc's theory objectio
form, is not removed in reality by the
of it.

The theory of mixed gases has been fo
ble on the principles of the mechanica
suspect that part of it which relates to t
of vapour in the atmosphere, will prov
when brought to the test of experime
all probability, supposed he had done a
tion of this theory required, by inven
separate equilibria; for nothing more
support of his opinions, particularly of
existence of uncombined vapour perva
unless the statement of the following
explanation of it, may be referred to thi
cels of dry air, which are equal in bulk
perature, be confined by equal column
tubes of equal bores, one of which is w
the air, which is thus exposed to wat
than that which is kept dry, provid
augmentations of their temperatures b
nomenon is thus explained on the prin
The vapour that arises from the sides o
sesses a spring of its own; therefore it
weight of the mercury from the air, ar
expand itself, so as to re-adjust the eq
to this explanation, if l and g represe
columns of dry and moist air at any
denote the length of a column of mer

to the pressure that confines the contents of the tubes; and if f be put for the spring of vapour of the same temperature measured by a column of mercury, we have $g = \frac{lc}{c-f}$; from which we also get $c = \frac{fg}{g-l}$: the last expression affords us an opportunity of comparing the preceding explanation, and therefore the theory itself, with facts; for, according to the experiments of Mr. Schmidt, 1000 parts of dry air, at 32 degrees of Fahrenheit, will expand to 1087·11 parts, by being raised to 59 degrees, in contact with water; call this number g; according to the same author, 1000 parts of dry air at 32 degrees will expand to 1053·61 parts, by being heated to 59 degrees in a dry tube: let this number be l; then $g - l = 33{\cdot}50$: but f, or the spring of vapour at 59 degrees, is 507, according to Mr. Dalton; then $fg = 551,164$; hence $c = 16{\cdot}15$ inches; which expresses the height of the barometer, together with the column of mercury contained in the tube. If the temperature be stated at 95 degrees, c will amount to little more than eight inches: now it is highly improbable that Mr. Schmidt made his experiments when the barometer stood at a height indicated by either of these numbers. This application of the theory to practice affords a presumptive evidence that the principles of it are not altogether just, supposing the experiments of Mr. Dalton and Mr. Schmidt to be correct; but a positive proof of a want of accuracy in these principles may be obtained by introducing a small change into the manner of conducting the experiment made with moist air. This alteration consists in discarding the stopple of mercury, and substituting the simple pressure of the atmosphere in the room of it; because, when this substance, which is impenetrable to steam, has been removed, the redundant vapour will, according to the theory, flow into the atmosphere, thereby leaving the moist air of the tube to follow the law of expansion observed by dry air. With a view to find whether this be the case or not, I filled a bottle with running water of the temperature of 59 degrees, which, when carefully poured out again, weighed 7794 grains. The bottle,

tle, having a dew left sticking to the sid
in water at the temperature of 126 de
which remained about an inch above t
vered with my hand, care being taken
quently for an instant to permit the va
air to escape. After keeping it in this s
minutes, I secured the mouth in the man
and inverted it in a quantity of the sa
was reduced to 59 degrees; in consequen
up 1622 grains of water, leaving a space
grains. If the experiment be now inv
air will occupy the space of 7794 such
perature is raised from 59 to 126 degre
double the expansion of dry air in like ci
according to Mr. Schmidt's experiments
air of 59 degrees will become equal to
by being heated to 126 degrees; ther
proportion, if 1000 parts give an expansi
parts, 6172 parts give only 820: but th
and 6172 is 1622, which is nearly the d
preceding experiment, and others which
same kind, demonstrate that moist air
dry air under like circumstances, and t
notion of uncombined elastic vapour mi
sphere. The accuracy of the fact ma
doubt, however, is removed by repeati
but so long as my statement remains
consequences of it to the theory in ques
troverted by argument: for if elastic v
ir, it does more than merely enter the
for, according to my experiment, it en
ow temperatures, which we know to b
he heat of the compound arises to 212
re convinced of the superior expansio
eadily apply the principle to certain inte
n particular to the origin of tornadoes
he variation of the barometer in tempe

Mr. Barrow, an intelligent traveller i
erves, that the atmosphere in Caffraria

to 102 or 104 degrees: this is succeeded by local thunder storms, attended with heavy falls of rain and hail, as well as violent hurricanes. I do not pretend to assign the refrigerating cause, or the agent that produces precipitation in this case; I only have to observe, that the portion of air must lose much of its elasticity, which is suddenly cooled to 70 or 72 degrees, and at the same time parts with the water it held in solution. This partial diminution of spring will destroy the equilibrium of the adjacent parts of the atmosphere, and may be supposed to produce the tornadoes of the tropical regions. The same cause probably gives rise to the fluctuations of the barometer in milder climates; for, though the changes of temperature are less in the milder than in the hottest parts of the globe, the agents that precipitate the water of the atmosphere appear to act on a more extensive scale, and through a longer duration, in the former situations than they do in the latter. Wet weather is neither momentary nor local in Europe; provinces, and even kingdoms, are deluged with rain for weeks together. The air, which discharges such an abundance of water, will lose part of its spring, according to Mr. Schmidt's experiments, even when it suffers no change of temperature: now it is evident that the equilibrium cannot be restored in an instant, because the diminished elasticity must be augmented in this case by currents of air coming from remote places. The diminution of spring in the atmosphere is shown by the fall of the barometer, and the subsequent ascent of the mercury indicates the arrival of the restorative currents. According to this explanation the barometer will rise slowly but gradually in the centre of the rainy district, while the motions of it will be more rapid and less regular towards the verge of the storm. High winds will also prevail in wet seasons, which will blow towards the parts where the elastic force of the air is least; that is, where the rains are most abundant.—I know not what claim to originality is due to the foregoing hints towards the theory of the barometer; they have, however, the merit of being a natural consequence of an established fact; I mean the great dilatation of air saturated with moisture, which must undergo a proportionate contraction when deprived of water.

XX. *An experimental Inquiry into the N*
and Calculous Concretions in the Huma
Effects of Alkaline and Acid Substanc
out of the Body. By THOMAS EGAN,

[Concluded from p. 86.]

Experiment XI.

As children are such frequent sufferers,
gested the propriety of ascertaining whe
fluence might be weakened by the additi
half of a calculus, of the uric acid ki
grains, extracted by my friend Mr.
(though under the most unpromising ci
dexterity and success not to be exceeded
was suspended in a lixivium consisting
distilled water and twenty drops of w
(partly aërated), and scarce imparting
To this were added thirty-six grains of
found adequate to sweeten it sufficientl
forty-eight hours in a temperature vary
100 degrees, or a medium one of 74 degr
weighed, it was found to lose ten grains
addition, then, of saccharine matter c
may add to the alkaline energy.

Experiment XII.

Ten grains of very pure crystallized
were dissolved in four ounces of dist
filtered lixivium was suspended a frag
the uric acid kind, weighing seventy-tw
ter, for forty-eight hours, on a sand-h
to 100 degrees (for the fire was not
night). Being taken out, dried, and w
to have lost seven grains and a quarte
a yellowish green colour, different fr
tinge of the pure alkaline ones. It al
without becoming sweet. A quantity
matter was separated, and the dissolve

the greater part, again precipitated, upon the mixture cooling, to the temperature of the atmosphere.

Experiment XIII.

The crystallized carbonate of potash, being generally prescribed in the proportion of one drachm to four ounces of water; in a similar mixture was suspended an entire calculus, of a very compact, rough, and gritty appearance, weighing forty grains and a quarter. After remaining forty-eight hours in the above temperature, it was taken out, dried, and weighed, and found to have lost three grains three quarters. The solution here more highly coloured than in the former: some spontaneous precipitation; and an immediate one, on the addition of a few drops of weak marine acid. We then find the vegetable alkali in the fullest state of saturation, with carbonic acid, that we can procure it, in the solid form, acting powerfully on these concretions, when assisted by degrees of temperature even much inferior to that of the human body.

Now, as to the mineral alkali, nature presents us with similar, nay, more extraordinary results, in the mild mineral alkaline impregnation of the waters of Carlsbad, in Bohemia. Here are several springs, varying in temperature from 114 degrees to that of the Brudel at 165 degrees. According to Elliot, they contain, in the gallon, of aërated lime 36 grains; muriate of soda 48; aërated soda 102; vitriolated soda 6 drachms; some minute proportion of iron, and a considerable carbonic acid impregnation. But Klaproth rates the proportion of mineral alkali still higher.

Of the lithontriptic effects of these waters, Springfield gives us a very surprising account indeed: founded, however, upon numerous experiments, instituted upon the spot, by the immersion of many calculi in the sources themselves; where they were either entirely dissolved, or acted upon with an energy that must appear incredible, if we did not consider the nature of the menstruum, its high temperature, and constant renewal by the flowing of the stream. Nay, the urine of patients who used these waters for a few days was found to possess powerful lithontriptic effects, as appeared by the

immersion of many calculi in it. For a
highly interesting experiments, too nu
here, I must beg leave to refer to his T
tiva Thermarum Carolinarum, in dissolv
præ Aqua Calcis vivæ.

From these experiments, as well as
effects of these waters, taken internall
calculous and gravelly patients who fr
establishes their superiority over the
other remedies hitherto in use, not
oyster-shell lime water. Now, the lim
bonated, and only kept in solution by
state, we can be at no loss, in those d
superior agency to the alkaline impreg
high a temperature. Klaproth affirms
drinks these waters, in the usual qua
days, takes of mild mineral alkali 391
1 drachm and 13 grains; which amou
and a half per day, besides the other s

Doctors Rutty and Smyth, who gav
from this publication, in the Memoir
Philosophical Society of this city, (no
Royal Irish Academy, but which, we h
were never published, and are now di
their account by the following query:
kaline lixivium be contrived by art, t
milar effects with these waters?" An
taken place in the instance of our sod
we not make a nearer approximatio
above specified proportion of minera
quantity of water, with the addition c
bonic acid, and the other saline ingredie
proper, afterwards heating, however,
160 degrees?

We find, then, the alkaline carbona
ratory of nature, as well as in our expe
siderable solvent powers upon these ar
trary to what has been hitherto suppos

Experiment XIV.

Into a filtered solution of ten grains of salt of tartar, in four ounces of distilled water, were introduced two fragments of calculi, weighing seventy-four grains and a quarter. The mixture was set aside for forty-eight hours in a cool room; temperature varying from 47 degrees at night, to 55 degrees in the day. After twelve hours it began to be coloured, and continued to be more so, until the temperature fell to 51 degrees, when a precipitation took place, and continued during the night; so that it appeared to deposit at the temperature of 47 degrees, what was taken up at degrees somewhat exceeding 51°. These fragments, on being taken out, dried, and weighed, were found to have lost three grains and three quarters; the laminæ disposed to crack, and the strata to separate and crumble. This weak lixivium, then, exerted much energy, even in a very low temperature.

Experiment XV.

A fragment of calculus, weighing seventeen grains three quarters, was immersed in a lixivium of similar strength; but now exposed to a temperature varying from 51 degrees at night to about 95 degrees in the day. After forty-eight hours, it was found to lose five grains and a half: a prodigious quantity, when we consider the small surface presented by this fragment, weighing only seventeen grains three quarters. The solution, upon cooling, became turbid as before, and precipitated a large proportion of the dissolved uric acid.

Experiment XVI.

A fragment of calculus, weighing forty grains three quarters, was immersed in four ounces of soda water for forty-eight hours, and exposed to a temperature varying from 55 to about 100 degrees. Its loss amounted to one grain. A repetition of this experiment afforded nearly the same result; and demonstrates, that though the soda, in this super-carbonated state, still exerts some energy on concretions of the uric acid kind, yet it is but feeble; and that these waters appear more capable of preventing their formation than effecting their solution, when they once ac state. The same fragment, in a simila water, in the temperature of from 50 t sustained no loss, after forty-eight hou have another proof of the necessity of se the degree of temperature in all researche

But it may be observed, as to the int substances in particular, that their effe derably weakened upon their immediate urine; as the small quantity that can must, in the first place, neutralize the phoric acid in all urine, the benzoic in compose the ammoniacal and magnesia of every period of life. It must be ackn is partly counteracted by these circumst never be overlooked, and always taken i tical application. Referring to Fourcro on this subject, Memoirs of the Na *Connoissances Chimiques*, let us here c the test of experiment.

Experiment XVII.

A fragment of calculus, weighing quarter, of the uric acid kind, was s eight hours, in an alkaline lixivium, ounces and a half of recent urine, a very weak, and partly aërated, causti temperature about 74 degrees. On b dried, it was found to have lost one g considerable quantity from so small filtered solution were added a few d acid, which, after a few minutes, preci stalline matter in a triple proportion o curs in the natural state of urine.

From the above experiments, the longer doubtful; first, that pure lim proportion contained in lime water, in an extreme state of dilution, in ten what inferior to those of the human s solvent power on calculi of the uric aci the alkaline carbonates, under similar circumstances, are possessed of similar powers, though in an inferior degree: and thirdly, that, by our having ascertained this point, we have removed a long established error, substituted a discovery highly interesting to animal chemistry, and likely to be productive of a more enlightened and successful practice in the treatment of these diseases.

In these expectations we shall appear to be the better founded, when it is considered, that, for want of entire specimens (preserved here like the oriental bezoars of old), we were obliged to operate upon fragments presenting small surfaces only to our solvents: that these last were never renewed during the course of the experiments, which would not have occurred in their application in the form of injections; as they should, in that case, be so often repeated, and act, of course, with renewed energy: that, either taken internally, or used in form of injection, the smallest proportion of alkaline matter, in a great state of dilution, assisted by the human temperature, answers our purpose; and that the temperature in our experiments was never permanent, and might be rated at the medium one of 74 degrees.

Having now fulfilled the second object of this essay, I would no longer presume to trespass on the indulgence of the academy, if I were not actuated by the sanguine hope of turning the attention of my surgical friends to the humane consideration of obviating, as much as possible, the most dangerous of operations by the prudent application of a few safe solvents injected into the bladder. How far they may succeed with calculi of the uric acid kind, may be already conjectured from the preceding experiments; but with those of the next most frequent occurrence there is much less difficulty to encounter, and every reason to hope for a speedy and safe result. The ammoniaco-magnesian phosphate is partly soluble in water, highly so in the carbonic acid (as we have already seen); and, consequently, more so in the weakest possible acid impregnations that can be devised; nothing more being necessary than the addition of as many drops only of weak muriatic acid as will scarce impart an acid taste. But as precept should, in every instance, be as

much as possible assisted by experimen
ncouragement of the young practitioner
his very soluble species the more willi
ssistance to expect from his professional
ects being only treated of in Philosoph
Memoirs of the National Institute, and a
chemical publications, if we except W
Lime Water, to which we would willing

Experiment XVIII.

An entire calculus, of a reddish, gritty
nally, proved to consist of ammoniac
phate, weighing forty-six grains one quar
for forty-eight hours, in a mixture consi
of distilled water and ten drops of weak
being taken out, and dried, it was fou
grains three quarters. The mixture w
acid taste, and precipitated, on the add
of fixed alkali, the ammoniaco-magnesi
that beautiful crystalline form so accu
Dr. Wollaston.

We may readily conceive how much
have amounted to in this case, in the
eight hours, if the menstruum had beer
under the regular influence of human te

Experiment XIX.

A fragment of the same species with
twelve grains, was immersed, for forty-
ounces of distilled water, without ad
from 60 to near 100 degrees. After b
dried, it was found to have lost one
became so friable as to crumble, and
pitate with a few drops of pure ammo
calculus, therefore, is soluble in water,
inferior to that of the human. It is
enter into a further detail of experimer
of the mixed kind, having the uric ac
monia, and sometimes, though rarel

intermixed in their strata. Suffice it to say, that the very dilute marine acid speedily takes up the earthy phosphates, leaves the laminæ of the uric acid bare and distinct, ready to crumble, and of easy solution in the weakest alkaline lixivia, and still more so in lime water:—a most important consideration in a practical point of view.

It would be trespassing too much on the already tried indulgence of the academy, to go further into the detail of the circumstances necessary to be attended to, and acquainted with, to ensure success in the application of these principles. These are already tolerably well detailed in the *Connoissances Chimiques*. To the gentlemen professors in the school of surgery it more particularly belongs; and from the zeal and talents now in full activity there, what may not be expected? Created only the other day, by a Cleghorn, (a name as deservedly as universally revered;) fostered, afterwards, by the anxious care and talents of Mr. Dease; we find it already arrived at a state of perfect maturity, and holding out to the student advantages no where to be rivalled, if indeed equalled: and that nothing may be wanting to a complete medical as well as surgical education, establishing a chair of botany, supported by the acknowledged abilities of Dr. Wade, both as a botanist and teacher. From the above experiments and observations we may presume to draw the following conclusions:

That acids, and acescent drinks of all kinds, give rise to gravelly and calculous affections, by causing a separation and precipitation of the native uric acid of urine within the body. That all acids, vegetable or mineral, nay, the native phosphoric acid of urine, in excess, are equally productive of this effect; the tartaric, perhaps, somewhat more so. That, on the other hand, we find lime, both the fixed alkalies, pure as well as aërated, (even in the smallest proportions,) serviceable in these disorders, by uniting with, and keeping in solution, this acid substance. That they also, in the smallest proportions, and diluted state, exert strong solvent powers on this acid in its aggregate form of calculus, provided their action be favoured by degrees of temperature approaching to the human. That, under the

same circumstance, contrary to what w
posed, the carbonated, sub-carbonated, n
bonated, exert similar influence, though
gree. That lime, even in the small pro
itself to us in lime water, is a most active
alculi of the uric acid kind, and its varic
s has been long since ascertained by Why
or weight, it exceeds even the caustic alk
ilution that the latter can be applied t
hat, finding four ounces of lime water
wo grains three quarters, take up, or det
hree quarters from a very compact calcul
o suppose this may arise from its actio
ating medium, its affinity to, and energy
eing so well known; and, if so, may we
ning from its power on the mulberry c
rmidable enemy? For, though it cannot
lime, it may the cementing medium,
liarly abounds.

For the application of these establish
rposes, I must refer to my surgical frie
ssessed of the necessary degree of chem
d I am happy to find this career already
end Mr. Crampton, who has favoured u
a pulmonary calculus in the Philosoph
d from whose professional as well as sc
ve every thing to expect in fulfilling (
n) his duties as a teacher.

Having now endeavoured to accomplis
this essay, which was, to establish exp
ar and comprehensive view of the nat
s, and the remedies employed to comb
herto possessed, I should not have tre
time of the academy, were it not prop
friend Dr. Clarke, that it would be
ertain how far the facts and notions, b
may stand confirmed or contradicted b
ctical application of them in Simps
blishment affording the best and most

observation, of this kind, of any in Europe, that of Luneville, perhaps, excepted.

The benefit of this charity extends equally to the blind and gouty. In the year 1795 I found it to contain thirty-two of the latter; and since that period thirty-four have been admitted: in all, sixty-six gouty patients. Of these, the greater number have either complained of gravel, or passed it without any previous or concomitant inconvenience: a circumstance which I had every day occasion to observe, whilst attending to the state of gouty urine. Among the blind and gouty, however, we may count about twenty-two as specifically more afflicted, having occasionally complained of marked and distinct symptoms of this disorder. Of these, we find sixteen among the gouty, and six only among the blind. Now, as the severity of gout is uniformly diminished, nay, in many instances, the disease entirely removed, by a residence of a few years only in the house, we must expect to find the same take place with respect to gravel, to which it is so strongly and nearly connected. And this singular alleviation of both diseases we can only attribute to the influence of temperance, and the manner of living, very opposite to that of their former habits. The diet in our house consists of bread and milk for breakfast and supper; beef, or mutton, with table beer, for dinner; all of the best quality, and administered with the greatest propriety and regularity; whilst the introduction of ardent spirits is prohibited, and sobriety enforced, by the strict discipline of the house. On the other hand, we find that, previous to their admission, they were either addicted to intemperance, or in the habit, at least, of muddling in public-houses, where, after a libation with porter, they indulged in the free use of acidulated punch (the constant nocturnal practice of our middling tradesmen and shopkeepers, who furnish the greatest proportion of our patients). The keeper of a porter-house of considerable resort informs me, that, to please the generality of his customers, he finds it necessary to add the juice of an entire lemon to about two quarts of punch; and that, from this circumstance, he would have experienced a considerable di-

nution of his profits, if he did not occas
am of tartar, or the dilute sulphuric acid :
e practice, in his opinion. Now, so sat
its of the pernicious effects of acids of a
l many of them refuse to make use
ing the summer months, through the
acescent quality (as was before observed)
ied to be the practice of Hewson, Khens
ers, for years back : nor do our present
rs, Sing and Cox, venture on it at an
greatest caution.

To a removal, then, from the former
may attribute no small share of the al
eases which takes place with us : a prac
t cannot be too generally known. Bu
ject :—On the slightest appearance of gr
connected with fever, or inflammatory
nary system, our patients have recour
dicine, the gravelly pills (as they ter
sist of desiccated soda, in the most co
pital practice, as well as most suited to
this (as first advised by Beddoes,) one
dition of a few grains of capsicum, or
and the necessary quantity of hard so
de into twenty pills. Of these, from
re, are taken in the twenty-four hou
ficient, not only to alleviate or remove
even to render the interference of the
n necessary. We have had also occasi
eral of our patients, induced by their
cts, carried these pills about them, s
nal recourse to them, without much
e or number.

To this practice, then, we would be dis
very pleasing and interesting considera
many gravelly patients, there has not
rse of ten years, a single operation o
the catheter, even in the hands of o
geon, Mr. Macklin, been able to disc

occasion for it. We could therefore have no opportunity of ascertaining the efficacy of injections into the bladder, as recommended by Whyte, Fourcroy, and myself.

I shall conclude by observing, that it would be interesting to have it in our power to extend these researches to the urine of those who live habitually on different aliment and drinks, particularly of the acescent kind, as well as to that of those who drink waters with mineral alkaline impregnations. But this desirable object can be only obtained by the concurrent exertions and attention of gentlemen of the faculty in different countries and situations. In private practice it is not to be expected; for here, wherever experiment is surmised to be the object, mistrust and suspicion take place of professional confidence. The use of the nitric acid in our venereal hospital, I hoped, would afford some useful facts as to its effects upon the saline contents of urine; the uric acid in particular. But I had not, as yet, sufficient leisure for that inquiry; nor could I, hitherto, obtain the urine of those using it, with all the circumstances necessary to enable me, at this moment, to draw any direct conclusions from my examination of it. In many instances, a morbid state of the urinary system (the urethra in particular) took place. In others, the combined effects of mercury interfered: and in all, no certainty of its not being blended with the urine of others not using this acid. I could not, however, help observing, that the few specimens, sent to me, agreed in one particular, viz. their exceeding very little, if at all, the usual healthy standard of acidity. This circumstance must excite our attention the more forcibly, when we consider, that two drachms of nitric acid, nay, sometimes three, diluted in the proportion of one pint of water to each drachm of acid, were taken daily; whilst, on the other hand, a few drops of the acid elixir of vitriol, or tincturæ martis in sp. salis, nay, the weak vegetable acids, and cream of tartar, persevered in for a few days, impart an additional degree of acidity to the urine. Would not this observation (if founded), conjoined with the easy decomposable nature of the acid itself, and its action on animal matter, induce us to lean to the opinion of those who have already asserted that this acid is

artly decomposed in the system, imparts
l that, perhaps, to a degree capable of
ying its properties as an acid?

And it may be here further remarked, in
h notion, that those gentlemen most co
e, as well as most capable of judging,
ıbts of its supposed diuretic effects, allow
the necessary quantity of its watery ve
n, truly deoxygenated in the system, wl
failure, as a radical cure of siphylis, fro
ls with it here, to other chronic disea
eady done in India?

I. *Extract of a Memoir of Messrs.* AUQUELIN *upon Guano, the natural* *outh Sea Islands near the Coast of P* *he National Institute. Drawn up by*

MONG the vast number of objects worth
naturalists which M. Humboldt has o
ed during his late travels, *guano* is one c
tance. In making us acquainted with
ıce, one of the principal resources of
ntries he has visited, this celebrated
hed the authors of this memoir with
firming a discovery which they had
ment of M. Humboldt's return. The
moir upon the existence of uric acid in
ls, created the idea in Humboldt that th
islands on the coast of Peru frequente
of birds, might be of the same descri
hemistry alone to decide the degree
conjecture is entitled. Messrs. Fourc
e undertaken the examination of this
pose laying before our readers the resul
nserted in the Memoirs of the Nationa

* From *Annales de Chimie*, vol. lvi.

Before giving an account of the experiments made upon guano in order to discover its nature, it may not be improper to communicate M. Humboldt's own opinion, as conveyed in a note to the authors of this memoir.

" Guano is found in great abundance in the South Sea, on the islands of Chincha, near Pisco; but it exists also on more southern shores and islands, such as Ilo, Iza, and Arica. The inhabitants of Chancay, who make a traffic of guano, go and return from the islands of Chincha in twenty days. Each vessel has on board from 1500 to 2000 cubic feet. A vanega costs at Chancay 14 livres, at Arica 15 livres tournois.

" It lies in beds of 50 or 60 feet deep, which are wrought like mines of iron ochre. These islands are inhabited by an immense quantity of birds, particularly of the ardea (the heron) and the phœnicopterus (flamingo) kinds, which always pass the night on shore; but it requires a period of three centuries before their excrements increase to four or five lines in thickness. Is guano a production caused by changes which the globe has undergone, like coal or fossil wood? The fertility of the otherwise steril shores of Peru is produced by the use of this substance, which is a staple article of commerce. Fifty small vessels called *guaneros* are continually employed in searching for it, and transporting it to the main land; and we may perceive the smell of it at a quarter of a league's distance. The sailors, who are accustomed to this ammoniacal odour, suffer no inconvenience from it, but it caused us to sneeze violently on approaching it. For the cultivation of mace, in particular, it furnishes a most excellent manure. The Indians have taught this method to the Spaniards. If too much guano, however, is thrown upon the mace, the root is burnt up, and destroyed. Guano is extremely acidifiable; so that here we have a manure of hydruret of azote, while other manures are rather hydrurets of carbon."

Guano has a reddish yellow colour; it is almost tasteless, but has a strong smell, which resembles at once that of castor and valerian. It blackens in the fire, exhaling a white smoke and an ammoniacal odour.

Its solubility in water, and, above all,
nined the method to be taken in its an
essively tried it by means of water, pot
cid: each of these trials gave occasion
hænomena, of which we shall give a
vithout entering into the details, which
ive for an extract.

Ten grammes of this substance, repeate
uantities of boiling water, were reduce
The ley had a reddish colour, and reddene

Submitted to distillation in B. M., it f
uring the whole operation: 24 hours a
ited a reddish yellow powder, a little
dour of castor; and it presented on its s
ellicle of the same colour as the precipit

The liquor, filtered and evaporated a s
as reduced to 3 grammes, still deposited
ish yellow powder, like the first, but les

The yellow powder and the mother
n solution were examined separately.

The former presented the following p
oncrete and pulverulent substance, of a b
ne appearance, and of a reddish yellow c
eat, it burns entirely, and gives out a sl
dour of ammonia and prussic acid. Alt
n cold water, it is easily so in warm, to
ates a yellowish colour; and, although t
ss, it reddens the tincture of turnsole
olutions of acetate of lead and of nitrate
ury in coloured flakes, which the nit
ompletely.

This substance dissolves instantly in
hich it communicates a brown colou
dour of ammonia. Sulphuric acid, mi
ated alkaline solution, yields a very th
te, and liberates a sharp smell similar t
cid.

The celebrated authors of the mem
ese experiments that this powder prese

dulated salt, formed from an animal acid, ammonia, and a little lime. In short, very weak nitric acid, in which this salt had been macerated to detach its acid from its bases, yielded, upon evaporation, vapours of ammonia in abundance by the addition of potash, and unequivocal signs of lime by the addition of oxalic acid.

Freed from ammonia and lime, this substance is less coloured, and appears less soluble than before: its solution in boiling water deposits brilliant crystals tolerably hard, and reddens more strongly turnsole paper. It combines with potash easily, and without the smell of ammonia: all the acids separate it from potash. It blackens by heat, and burns without leaving any residue, giving out a smell of ammonia and prussic acid. Its neutral combination with ammonia does not precipitate the solution of sulphate of alumine, as the honistic acid does.

It results from all these facts, 1st, That the substance extricated from guano by boiling water is an acid partly saturated with ammonia and a little lime: 2d, That this acid is of an animal nature, since it yields ammonia and prussic acid on being decomposed by fire: 3d, That this acid, according to all the properties already indicated, is uric acid, and similar to that of the excrements of aquatic birds: 4th, That it forms about the fourth part of guano.

The mother water which deposited the powder, the properties of which are about to be detailed, is very acid: potash liberates from it ammonia in abundance; it therefore contains an ammoniacal salt: the nitrates of barytes and silver announce the presence of the muriatic and sulphuric salts in it also: lime water precipitates from it white flakes, difficult of solution in the muriatic acid.

This precipitate, occasioned by lime water, is evidently formed of two salts: both dissolve in the acids without effervescence: the one is easily dissolved, without the assistance of heat; the other is dissolved with difficulty, even by the assistance of heat. The former resists calcination; the latter is decomposed by fire, and afterwards dissolves in the acids with effervescence. The one is phosphate and the other oxalate of lime.

The weak nitric acid was made use of
auquelin with an intention of separating
ithout making them experience any alt
olved the phosphate of lime, without touc
his last salt, tried with a solution of car
ielded a precipitate which dissolved with
ie nitric acid: this solution evinced all
itrate of lime. The acid separated from
ith the potash. In short, the liquor pr
ers of the oxalate of potash. Lime water
a very subtle powder. Sulphate of lime
ght flakes, and precipitates were formed
olutions which precipitate oxalic acid.
ine did not form any precipitate, as mi
ith *honistate* of potash.

The potash which the illustrious auth
ound in the mother water of guano aft
y means of lime water, the liberation c
ey obtained by the addition of potash
er before its decomposition by lime wate
hat these two alkalies saturate the aci
other water of guano: thus this mot
ontains oxalates, phosphates, sulphates
otash and ammonia.

The five grammes and seven-tenths r
ction of the water upon the ten gram
itted to the analysis, were tried by cau
ok eight-tenths from them: this alk
ined nothing else than the uric acid, a
f fatty matter.

The muriatic acid, to the action of w
es and nine-tenths not attacked by pc
itted, did not present upon analysis
hosphate of lime, iron, and an atom of

The water, the potash, and the muriat
mployed, left no other residue out of te
han three grammes, and a tenth part of
ecognised to be a mixture of a quart
and.

The result of this interesting analysis is; that the South Sea manure is formed,

1. Of uric acid, which forms the fourth part, and which is partly saturated with ammonia and lime.
2. Of oxalic acid, partly saturated with ammonia and potash.
3. Of phosphoric acid, combined with the same bases and with lime.
4. Of small quantities of sulphates and muriates of potash and ammonia.
5. Of a little fatty matter.
6. Of sand, partly quartz and partly iron.

The existence of guano in the places where such multitudes of birds assemble, the identity of its nature with that of the excrements of aquatic birds, necessarily throw great light upon the origin of this substance.

Its analysis proves how well founded the ingenious naturalist is in his opinion, to whom we are indebted for our knowledge of this substance, equally interesting to us as useful to the inhabitants of Peru. The analysis, also, confirms the important discovery, which is the happy fruit of the researches of Fourcroy and Vauquelin. In short, it has the advantage of recalling this well known truth, that the sciences mutually enrich each other, in aiding each other with the various lights they possess; and it furnishes a new occasion to remark, that among all the sciences none have a more immediate and more necessary connection than chemistry and natural history.

XXII. *Analysis of Birdlime.* *By M.* Bouillon-Lagrange*.

I. *Origin and Mode of Preparation.*

The substance termed birdlime is classed among the immediate products of vegetables. M. Fourcroy is the first who regarded it as glutinous: he has placed it as a species under

---

* From the *Annales de Chimie*, tom. lvi.

nder this general head in his *Systême himiques*, vol. vii. p. 306.

Birdlime, says this chemist, is procure f the misletoe and the tender bark of the om many other trees, by maceration in v o one has hitherto examined this substan ccuracy, it presents many points of resen ous bodies.

With the exception of what is said in ourse of Chemistry, I know no work in thrown upon the nature of this singular

M. Chaptal, in his Elements of Chemi f its preparation: as the process which iffers in nothing from that which is fou ledica of Geoffroy, and in the Dictiona omare, I shall quote the article respecti f this substance:—“ The antients emplo e misletoe of the oak: they boiled the f ruised them, and strained off the warm arate the seeds and skins. But we no me procured from the bark of the holl hich is the tenderest and greenest, is m llowed to putrefy under ground; it is the o reduce it into a paste, which is wash ater. This substance was considered mollient when applied externally.”

We know also that the misletoe of th redient in many pharmaceutical prepar niversal water, the antispasmodic pow owder.

The English, according to Geoffroy, pr rom the bark of the holly. They boil n water for seven or eight hours, until it t is then formed into balls, which are pl n numerous layers, one above another, osed; the water being previously all hey are suffered to remain to ferment an ight or three weeks, until they have mucilage. They are next removed and till they can be worked like paste; after this they are washed in a stream of water, and kneaded together, so as to remove all foreign matters. The paste is now deposited in earthen vessels for four or five days, till it throws up a scum and purifies. It is then put up in proper vessels, and is ready for sale.

This mode of preparing it is not generally adopted; each county has its own process, and there are even some persons who keep their method secret.

At Nogent-le-Rotron birdlime is prepared from the shreds of the second bark of the holly: it is allowed to ferment in a moist place for fifteen days, and then boiled in water, which is afterwards evaporated.

At Commercy and in its vicinity this substance is procured from different shrubs, as the holly, the *viburnum lantana*, and the misletoe; from every different tree, such as the apple, the pear, the lime, &c.

The best is obtained from the prickly holly, and is of a greenish colour: that which is made from the viburnum lantana is yellowish. When this vegetable is employed, they uniformly reject the epidermis, and use only the second bark.

I prepared the birdlime which I used in my experiments from the inner bark of the holly. On comparing it with some which was made with great care, and sent me from Commercy, I was unable to discover any sensible difference. These precautions appeared to me necessary, that a greater degree of accuracy might be given to the analysis. We well know that the birdlime of commerce is seldom pure; it is often a mere mixture of vegetable and animal matter, and often adulterated with turpentine, oil, vinegar, &c.: it is therefore absolutely necessary to ascertain previously the purity of this substance; and the process which I adopted yielded me birdlime of the best quality.

I took the inner bark of the holly, bruised it well, then boiled it in water about four or five hours, and, having thrown out the water, placed the bark in earthen pots under ground: I allowed it to remain there till it putrefied, or rather became viscid, taking care to sprinkle it with water from time to time. When this pro washed it, so as to remove all foreign

II. *Chemical and Physical Prop*

Birdlime has a greenish colour; glutinous, ropy, and tenacious: its linseed oil.

When spread upon a plate of glass time to the air and light, it dries and this state it is no longer viscid: when it may be reduced to powder; it has nous properties, and it cannot resum of water.

Birdlime reddens the tincture of tu alone in a porcelain cup it melts wit quid; it swells up and forms bubbles, face and then burst. This kind of black grains, which give it an uneven an odour very similar to that of the f perature is raised.

If the birdlime be kept in fusion quires a brownish colour; but again ties on cooling. When placed upo with a flame, and emits an abundanc

Heated in a crucible of platina, it crucible becomes red. Its flame is b seven inches: it is attended with a c smoke, which is readily condensed chimney. The combustion continues is removed from the fire. There re which is very alkaline, and partly sol use of re-agents we ascertain the pre muriate of potash.

The portion which is insoluble in w the muriatic acid, dissolves with effer

The solution is copiously precipit ammonia; prussiate of potash produc and with ammonia it lets fall a matt ence, which is partly soluble in causti facts we should be led to conclude, that the ashes contain, besides the salts soluble in water, a quantity of the carbonates of lime and alumine, with a little iron.

Water has very little action upon birdlime. When raised to boiling, the matter does not completely melt; it acquires rather more fluidity, but resumes its former consistence by cooling. The water has no colour; its taste is nauseous, and then bitter: it reddens the tincture of turnsole. When evaporated to the consistence of syrup it becomes coloured, and assumes a mucilaginous appearance. The admixture of alcohol separates this matter.

Water, therefore, only dissolves a mucilaginous substance, and a little extractive matter.

Caustic potash, on the other hand, has a very different action. Its concentrated solution immediately forms with birdlime a whitish magma, which becomes brown by evaporation: there is at the same time a disengagement of ammonia.

The compound formed is less viscid: it acquires a greater hardness by exposure to the air: its odour and taste are similar to those of soap.

It is completely soluble in alcohol, with the exception of a few vegetable remains. These solutions become muddy on the addition of the strong acids, and exhibit the other phænomena which are observed in the solutions of soap.

The weaker acids soften birdlime, and partly dissolve it; but when concentrated they act in a different manner. Sulphuric acid blackens and chars it: if powdered lime be added so as to form a thick magma, a disengagement of acetic acid and ammonia takes place: there is no doubt that, besides the free acetic acid contained in the birdlime, a new quantity is formed by the action of the sulphuric acid.

The nitric acid has little action in the cold upon the substance under examination; but if the temperature be raised it becomes yellow, melts, and as the evaporation proceeds the matter swells considerably, and a hard brittle mass remains. When submitted a second time to the action of the nitric acid, a solution is effected, and a part of this substance

s converted into the malic and oxalic acid
he evaporation we obtain a yellow and v
vhich softens between the fingers like w
he same time a degree of elasticity, and m
eat.

Potash combines with this matter, char
our to a brown, and forms with it a true

Alcohol dissolves it in part; forming
vhich loses its transparency on the additi

If the alcohol be evaporated to dryness,
emains, which has no longer a greasy ap
uses an agreeable odour when burnt.

Muriatic acid has no action on birdlim
vhen heated, blackens it.

Oxymuriatic acid, on the other hand,
nd more powerful action on this subst
he gas through water containing liquef
haking it in a flask along with very stro
he following phænomena:—the birdlim
olour, becoming white; it is now no
eparates into hard compact masses, w
hem a portion of the substance unalt
lete oxygenation may be ascribed, with
o the difficulty of preserving the birdlim
er, and the consequent obstacle to th
eyond the external layer.

The characters of oxygenated birdli
e readily reduced to powder: 2d, It is
ven when heated: 3d, It refuses to mel
erature: 4th, It does not become yell
vhen subjected to the action of the nitri

The acetous acid softens birdlime, a
ortion of it: the solution has a yello
eous taste: with the carbonate of pota
ipitate: when evaporated it yields a
roperties of a resin, but cannot be
omplete dryness.

Some of the metallic oxides are re
eated with birdlime.

The semi-vitreous oxide of lead acquires a gray colour, dissolves, and forms a kind of plaster with this substance.

Boiling alcohol, of forty degrees strength, dissolves birdlime: the solution is clear, transparent, and of a yellow colour, but as it cools it becomes muddy.

By the filter we can separate from the solution a yellow matter which softens more readily than entire birdlime, and which melts with a gentle heat; diffusing an odour very similar to that of wax, which indeed it resembles in all its characters.

The filtered liquor is bitter, nauseous, and acid; it lets fall a precipitate by water, and leaves on evaporation a substance similar to resin.

Sulphuric ether may be regarded as the true solvent of birdlime: it acts upon this substance readily, divides, and in the end dissolves it almost entirely, leaving a little vegetable matter. The liquor assumes a greenish yellow colour, and reddens strongly the tincture of turnsole. By the addition of a small quantity of water it becomes muddy, and the ether rises to the surface; but if the water be added in sufficient quantity to dissolve the ether, a layer of oil exactly similar to the oil of linseed forms on the surface: with the semi-vitreous oxide of lead this last forms a plaster.

The ethereal solution yields, by evaporation, a yellow substance, which is greasy and soft like wax.

Conclusion.

From what has been now stated it must be very apparent that little analogy exists between birdlime and glutinous matter.

A simple recapitulation will suffice to point out the proper place which this substance ought to occupy among the products of vegetables.

Birdlime is viscid and elastic: it dries slightly by exposure to the air, and becomes brown, but never acquires the brittleness and unalterable properties of glue.

It melts in the fire, inflames, swells up, and burns with a bright flame; but does not diffuse that animal odour which gluten is observed to do.

Water does not dissolve birdlime, but
mucilage, extractive matter, and acetic a
stance contains.

Alkalies dissolve it, and when concen
it into a true soap.

Weak acids soften, and in part dissolv

The concentrated sulphuric acid black

Nitric acid communicates to it a yello
verts it partly into the oxalic and malic a
resin and wax.

The oxymuriatic acid renders it white
oxygenated birdlime.

Alcohol has little action on birdlime;
the resin and takes up the acid.

Lastly, Sulphuric ether dissolves it en

Birdlime, therefore, differs from glue i
ticulars:

1. It contains a quantity of free aceto

2. It has very little of an animal nat

3. Both mucilage and extractive ma
from it.

4. By the action of the nitric acid it
tity of resin.

5. It is soluble in ether.

XXIII. *On a new Varnish for Wooc*
MENTIER[*].

THE apothecary of the French militar
M. Bompoix, has sent me some coffee-
of which appeared at first to arise from
afterwards I discovered that they were
account of the varnish which covered
enjoys a great reputation, and the com
a profound secret in that country;
M. Bompoix to use every exertion to
from which it is made; and he at last
of one of his pupils, whose intimacy wi

---

[*] From *Annales de Chimie*, to

manufactory procured him the following recipe, and an article was produced by the use of it equal in quality to the original:

Take of linseed oil one pound and a half.
Amber, one pound.
Pulverized litharge, five ounces.
Pulverized minium (red lead) five ounces.
Pulverized white lead, five ounces.

Boil the linseed oil in an unglazed vessel; make a bag of linen in which the litharge, minium, and white lead may be contained; and suspend it, with its contents, in the vessel; taking care not to allow it to touch the bottom. Continue the ebullition until the oil begins to become brown; then take out the bag with its ingredients and continue to boil the oil, adding a clove of clean garlic; and when this is dried up put in another, and so on to the number of six or seven.

Then melt the amber in an unglazed earthen vessel in the following manner, and when melted pour it into the prepared linseed oil.

Manner of melting the Amber.

Take about two ounces of the linseed oil and add it to the amber, and facilitate its melting by a strong fire: when it is melted mix it with the rest of the linseed oil and boil the whole two minutes; then remove it and strain it through a fine linen cloth; and when it is cold put it into a bottle and stop it well, in order to prevent it from drying up.

Manner of using it.

Take the article which you want to varnish, and polish it well before applying the varnish, which is to be done in the following manner:

Take lamp black, the varnish thus prepared, and a little essence of turpentine; mix them together, and with a pencil lay a coating upon the piece which is to be varnished; when that coat is dry lay on others to the number of four; and when these are dry also, place the article in a stove or furnace,

nace, in order to dry it entirely, and aft
powdered pumice-stone and Tripoli.

Manner of preparing the Article whic

It is necessary to make use of walnut
tree wood, because these woods are por
are perfectly dry they will turn better
the article is shaped to your liking yo
stove to dry, after which work it and p
be completely finished, then apply the v
above described.

If it is wanted to give the dish a re
nium, or rather cinnabar, may be put i
the same may be done with any other
give to the article varnished.

XXIV. *Account of a Series of Exper*
Effects of Compression in modifying
By Sir James Hall, *Bart. F.R.S.*

I. *Antient Revolutions of the Mineral*
tempts to explain them.—Dependence
mistry.—Importance of the Carbon
Black's Discovery of Carbonic Acid
Theories depending on Fire, but gave
Hutton.—Progress of the Author's
that Theory.—Experiments with Hea
suggested to Dr. Hutton in 1790.—
Author in 1798.—*Speculations on wh*
cess were founded.

Whoever has attended to the str
mountains, must be convinced that our
existed in its present state; but that e
so far at least as our observations reac
and subverted by the most violent revo

---

* From *Transactions of the Royal Society of*

Facts leading to such striking conclusions, however imperfectly observed, could not fail to awaken curiosity, and give rise to a desire of tracing the history, and of investigating the causes, of such stupendous events; and various attempts were made in this way, but with little success; for, while discoveries of the utmost importance and accuracy were made in astronomy and natural philosophy, the systems produced by the geologists were so fanciful and puerile, as scarcely to deserve a serious refutation.

One principal cause of this failure seems to have lain in the very imperfect state of chemistry, which has only of late years begun to deserve the name of a science. While chemistry was in its infancy, it was impossible that geology should make any progress; since several of the most important circumstances to be accounted for by this latter science are admitted on all hands to depend upon principles of the former. The consolidation of loose sand into strata of solid rock; the crystalline arrangement of substances accompanying those strata, and blended with them in various modes; are circumstances of a chemical nature, which all those who have attempted to frame theories of the earth have endeavoured by chemical reasonings to reconcile to their hypotheses.

Fire and water, the only agents in nature by which stony substances are produced, under our observation, were employed by contending sects of geologists to explain all the phænomena of the mineral kingdom.

But the known properties of water are quite repugnant to the belief of its universal influence, since a very great proportion of the substances under consideration are insoluble, or nearly so, in that fluid; and since, if they were all extremely soluble, the quantity of water which is known to exist, or that could possibly exist, in our planet, would be far too small to accomplish the office assigned to it in the Neptunian theory*. On the other hand, the known properties of fire are no less inadequate to the purpose; for various substances which frequently occur in the mineral kingdom,

---

* Illustrations of the Huttonian Theory, by Mr. Professor Playfair, 430.

dom, seem, by their presence, to
agency; since experiment shows, tha
totally changed or destroyed.

Under such circumstances the advo
were enabled, very successfully, to
their adversaries, though they could
own: and owing perhaps to this mu
and for want of any alternative to w
men could lean, both systems mainta
credit; and writers on geology indul
sort of impunity, in a style of unp
which would not have been tolerated

Of all mineral substances the car
questionably the most important in
limestone or marble it constitutes a ve
the solid mass of many countries, an
and nodules of spar pervades every
history is thus interwoven in such a m
mineral kingdom at large, that the f
theory must very much depend upon
tion to the various conditions of thi
Dr. Black, by his discovery of carbon
chemical nature of the carbonate, no
be formed of the chemical revolutions
edly undergone.

This discovery was in the first insta
posed action of fire; for the decompo
fire in every common kiln being thus
surd to ascribe to that same agent th
stone, or of any mass containing it.

The contemplation of this difficult
view the action of fire in a manner pe
thus to form a geological theory, by w
he has furnished the world with the t
the most interesting problems that
attention of men of science.

He supposed,

I. That heat has acted, at some
rocks.

II. That during the action of heat all these rocks (even such as now appear at the surface) lay covered by a superincumbent mass, of great weight and strength.

III. That in consequence of the combined action of heat and pressure, effects were produced different from those of heat on common occasions; in particular, that the carbonate of lime was reduced to a state of fusion, more or less complete, without any calcination.

The essential and characteristic principle of his theory is thus comprised in the word compression; and by one bold hypothesis, founded on this principle, he undertook to meet all the objections to the action of fire, and to account for those circumstances in which minerals are found to differ from the usual products of our furnaces.

This system, however, involves so many suppositions, apparently in contradiction to common experience, which meet us on the very threshold, that most men have hitherto been deterred from the investigation of its principles, and only a few individuals have justly appreciated its merits. It was long before I belonged to the latter class; for I must own that, on reading Dr. Hutton's first geological publication, I was induced to reject his system entirely, and should probably have continued still to do so, with the great majority of the world, but for my habits of intimacy with the author; the vivacity and perspicuity of whose conversation formed a striking contrast to the obscurity of his writings. I was induced by that charm, and by the numerous original facts which his system had led him to observe, to listen to his arguments in favour of opinions which I then looked upon as visionary. I thus derived from his conversation the same advantage which the world has lately done from the publication of Mr. Playfair's Illustrations; and experienced the same influence which is now exerted by that work on the minds of our most eminent men of science.

After three years of almost daily warfare with Dr. Hutton, on the subject of his theory, I began to view his fundamental principles with less and less repugnance. There is a period, I believe, in all scientific investigations, when the conjectures of genius cease to appear extravagant, and when we balance the fertility of a principl phænomena of nature, against its impr thesis: the partial view which we the perhaps the most attractive of any, a stimulates the exertions of an active mi obscured some objects dissipates by them to appear in their true colours; distant prospect opens to our view, of before.

Entering now seriously into the tr lowed by Dr. Hutton, I conceived that ascribed by him to compression, ought, be investigated; for unless some good for believing that heat would be modifie manner alleged, it would avail us little had acted together. He rested his belie analogy, and on the satisfactory solutio mena furnished by this supposition. however, that this principle was suscep blished in a direct manner by experime to make the attempt; but he always re on account of the immensity of the na operations he supposed to lie far beyon imitation; and he seemed to imagine th must undoubtedly fail, and thus throw already sufficiently established, as he principles. I was far, however, from these arguments; for, without being abl artificial compression to which we co bonate would effectually prevent its cal I maintained, that we had as little pro and that the application of a moderate perform all that was hypothetically assu theory. On the other hand, I conside in practice to pay deference to his opini he had already so nobly occupied, a the remainder of his life, from the pro periments with compression which I h

In 1798 I resumed the subject with

of opinion that the chemical law which forms the basis of the Huttonian theory ought, in the first place, to be investigated experimentally; all my subsequent reflections and observations having tended to confirm my idea of the importance of this pursuit, without in any degree rendering me more apprehensive as to the result.

In the arrangement of the following paper I shall first confine myself to the investigation of the chemical effects of heat and compression, reserving to the concluding part the application of my results to geology. I shall then appeal to the volcanos, and shall endeavour to vindicate the laws of action assumed in the Huttonian theory, by showing that lavas, previous to their eruptions, are subject to similar laws; and that the volcanos, by their subterranean and submarine exertions, must produce, in our times, results similar to those ascribed, in that theory, to the former action of fire.

In comparing the Huttonian operations with those of the volcanos, I shall avail myself of some facts, brought to light in the course of the following investigations, by which a precise limit is assigned to the intensity of the heat, and to the force of compression, required to fulfil the conditions of Dr. Hutton's hypothesis: for according to him the power of those agents was very great, but quite indefinite; it was therefore impossible to compare their supposed effects in any precise manner with the phænomena of nature.

My attention was almost exclusively confined to the carbonate of lime, about which I reasoned as follows: the carbonic acid, when uncombined with any other substance, exists naturally in a gaseous form at the common temperature of our atmosphere; but when in union with lime, its volatility is repressed, in that same temperature, by the chemical force of the earthy substance which retains it in a solid form. When the temperature is raised to a full red-heat, the acid acquires a volatility by which that force is overcome, it escapes from the lime, and assumes its gaseous form. It is evident, that were the attractive force of the lime increased, or the volatility of the acid diminished by

any means, the compound would be
higher heat without decomposition than i
state of things. Now pressure must pr
this kind; for when a mechanical force
sion of the acid, its volatility must, to a
diminished. Under pressure, then, the
expected to remain unchanged in a heat
open air, it would have been calcined.
alone can teach us what compressing fo
enable it to resist any given elevation o
what is to be the result of such an opera
compounds of lime with acids are fusi
tory; the carbonate, when constrained
dure a proper heat, may be as fusible as t

One circumstance, derived from the
induced me to hope that the carbonate
and indicated a precise point under whic
to be expected. Nothing is more com
with nodules of calcareous spar inclosed
we suppose, according to the Huttoni
whin and the spar had been liquid toge
keeping separate like oil and water. I
junction of these two, to look for indicat
fusibilities; and we find, accordingly,
of the spar is generally globular and sn
to prove that, when the whin became
still in a liquid state; for had the spar
tendency which it shows, on all occas
shoot out into prominent crystals, wou
into the liquid whin, according to the
crystallization, as has happened with th
contained in whin, much more ref
namely, augite, felspar, &c., all of wh
in the liquid whin, have assumed their
perfect regularity. From this I concl
whin congealed, which must have h
30° of Wedgwood, the spar was stil
expected, if I could compel the carbo

28° without decomposition, that it would enter into fusion. The sequel will show that this conjecture was not without foundation.

I shall now enter upon the description of those experiments, the result of which I had the honour to lay before this society on the 30th of August last (1804); fully aware how difficult it is, in giving an account of above five hundred experiments, all tending to one point, but differing much from each other in various particulars, to steer between the opposite faults of prolixity and barrenness. My object shall be to describe, as shortly as possible, all the methods followed, so as to enable any chemist to repeat the experiments; and to dwell particularly on such circumstances only as seem to lead to conclusions of importance.

The result being already known, I consider the account I am about to give of the execution of these experiments, as addressed to those who take a particular interest in the progress of chemical operations:—in the eyes of such gentlemen I trust that none of the details into which I must enter will appear superfluous.

II. *Principle of Execution upon which the following Experiments were conducted.—Experiments with Gun-Barrels filled with baked Clay, and welded at the Muzzle.—Method with the Fusible Metal.—Remarkable Effects of its Expansion.—Necessity of introducing Air.—Results obtained.*

When I first undertook to make experiments with heat acting under compression, I employed myself in contriving various devices of screws, of bolts, and of lids, so adjusted, I hoped, as to confine all elastic substances; and perhaps some of them might have answered. But I laid aside all such devices, in favour of one which occurred to me in January 1798; which, by its simplicity, was of easy application in all cases, and accomplished all that could be done by any device, since it secured perfect strength and tightness to the utmost that the vessels employed could bear, whether formed of metallic or earthy substance. The device

pends upon the following general view : I
tube or barrel (AD, fig. 1. Plate IV.) cl
open at the other, of one foot or more
dent, that by introducing one end into a f
ply to it as great heat as art can produce,
is kept cool, or, if necessary, exposed t
then the substance which we mean to sub
ed action of heat and pressure be intro
ech or closed end of the barrel (CD), a
t be filled with some refractory substance
pty space at the muzzle (AB), we can
zzle, while the breech containing the s
nt is kept cool, and thus close the bar
merous modes which heat affords, from
n to the melting of sealing-wax. Thin
sed, and the breech put into the furnac
uired intensity may be applied to the s
nt, now in a state of constraint.

My first application of this scheme was
mmon gun-barrel, cut off at the touch-
y strongly at the breech by means of a p
I introduced the carbonate, previously
tridge of paper or pasteboard, in order
iron, by which, in some former tria
periment had been contaminated throu
ion of heat. I then rammed the rest o
unded clay, previously baked in a stron
muzzle closed, like the breech, by a pl
on it in a common forge ; the rest of
pt cold during this operation by mea
e breech of the barrel was then intro
o a common muffle, heated to about 2
the muzzle a rope was fixed in such
rrel could be withdrawn without dang
n*. I likewise, about this time, clo

---

* On one occasion the importance of this preca
ving inadvertently introduced a considerable qua
lded barrel, an explosion took place, before the

the barrel by means of a plug fixed by solder only; which method had this peculiar advantage, that I could shut and open the barrel without having recourse to a workman. In these trials, though many barrels yielded to the expansive force, others resisted it, and afforded some results that were in the highest degree encouraging, and even satisfactory, could they have been obtained with certainty on repetition of the process. In many of them chalk, or common limestone previously pulverised, was agglutinated into a stony mass, which required a smart blow of a hammer to break it, and felt under the knife like a common limestone; at the same time the substance, when thrown into nitric acid, dissolved entirely with violent effervescence.

In one of these experiments, owing to the action of heat on the cartridge of paper, the baked clay, which had been used to fill the barrel, was stained black throughout, to the distance of two-thirds of the length of the barrel from its breech. This circumstance is of importance, by showing, that though all is tight at the muzzle, a protrusion may take place along the barrel, greatly to the detriment of complete compression: and, at the same time, it illustrates what has happened occasionally in nature, where the bituminous matter seems to have been driven by superior local heat from one part of a coaly bed, though retained in others, under the same compression; the bitumen so driven off being found, in other cases, to pervade and tinge beds of slate and of sandstone.

I was employed in this pursuit in spring 1800, when an event of importance interrupted my experiments for about a year. But I resumed them in March 1801, with many new

---

by which part of the barrel was spread out to a flat plate, and the furnace was blown to pieces. Dr. Kennedy, who happened to be present on this occasion, observed, that notwithstanding this accident, the time might come when we should employ water in these experiments to assist the force of compression. I have since made great use of this valuable suggestion: but he scarcely lived, alas! to see its application; for my first success in this way took place during his last illness.—I have been exposed to no risk in any other experiment with iron barrels; matters being so arranged that the strain against them has only commenced in a red heat, in which the metal has been so far softened as to yield by laceration like a piece of leather.

plans of execution, and with considerabl
apparatus.

In the course of my first trials, the f
execution had occurred to me, which I n
practice. It is well known to chemists th
position of different metals* produces a su
as to melt in the heat of boiling-water.
great advantage, both in point of accur
might be gained in these experiments, b
metal for the baked clay above mentioned
ducing the carbonate into the breech of th
ble metal, in a liquid state, might be pou
the barrel to its brim: that when the met
become solid, the breech might, as bef
into a muffle, and exposed to any requir
muzzle was carefully kept cold. In this
the fusible metal being melted but what
the rest, continuing in a solid state, wou
fine the carbonic acid: that after the act
had ceased, and after all had been allo
pletely, the fusible metal might be ren
the barrel, by means of a heat little abo
water, and far too low to occasion any de
carbonate by calcination, though acting
and then that the subject of experiment
taken out of the barrel.

This scheme, with various modifica
which practice has suggested, forms the
following methods.

In the first trial a striking phænomen
gave rise to the most important of
Having filled a gun-barrel with the fu
any carbonate, and having placed the b
was surprised to see, as the heat approa
liquid metal exuding through the iron
nute drops dispersed all round the barr
vanced this exudation increased, till at
out in continued streams, and the barre

---

* Eight parts of bismuth, five of lead,

On several occasions of the same kind, the fusible metal, being forced through some very minute aperture in the barrel, spouted from it to the distance of several yards, depositing upon any substance opposed to the stream a beautiful assemblage of fine wire exactly in the form of wool. I immediately understood that the phænomenon was produced by the superior expansion of the liquid over the solid metal, in consequence of which the fusible metal was driven through the iron as water was driven through silver* by mechanical percussion in the Florentine experiment. It occurred to me that this might be prevented by confining along with the fusible metal a small quantity of air, which, by yielding a little to the expansion of the liquid, would save the barrel. This remedy was found to answer completely, and was applied in all the experiments made at this time†.

I now proposed, in order to keep the carbonate clean, to inclose it in a small vessel; and to obviate the difficulty of removing the result at the conclusion of the experiment, I further proposed to connect that vessel with an iron ramrod,

---

* Essays of Natural Experiments made in the Academie del Cimento, translated by Waller, London, 1684, page 117. The same in Musschenbroek's Latin translation, Lugd. Bat. 1731. p 63.

† I found it a matter of much difficulty to ascertain the proper quantity of air which ought to be thus inclosed. When the quantity was too great, the result was injured by diminution of elasticity, as I shall have occasion fully to show hereafter. When too small, or when by any accident the whole of this included air was allowed to escape, the barrel was destroyed.

I hoped to ascertain the bulk of air necessary to give liberty to the expansion of the liquid metal, by measuring the actual quantity expelled by known heats from an open barrel filled with it. But I was surprised to find that the quantity thus discharged exceeded in bulk that of the air which, in the same heats, I had confined along with the carbonate and fusible metal in many successful experiments. As the expansion of the liquid does not seem capable of sensible diminution by an opposing force, this fact can only be accounted for by a distention of the barrel. In these experiments then the expansive force of the carbonic acid, of the included air, and of the fusible metal, acted in combination against the barrel, and were yielded to in part by the distension of the barrel, and by the condensation of the included air. My object was to increase the force of this mutual action, by diminishing the quantity of air, and by other devices to be mentioned hereafter. Where so many forces were concerned, the laws of whose variations were unknown, much precision could not be expected, nor is it wonderful that, in attempting to carry the compressing force to the utmost, I should have destroyed barrels innumerable.

onger than the barrel, by which it could
vithdrawn at pleasure.

A small tube of glass*, or of Reaumur
quarter of an inch in diameter, and one
ength (fig. 2. A), was half filled with pou
ime, rammed as hard as possible; the
ube being filled with pounded silex, or v
urred as most likely to prevent the intrus
netal in its liquid and penetrating state.
vas placed in a frame or cradle of iron (*d*
nd 6,) fixed to the end (*m*) of a ramrod (
vas from six to three inches in length, an
neter as a gun-barrel would admit with e
osed of two circular plates of iron (*d e f*
dgewise in the figures), placed at right a
od, one of these plates (*d e f h*) being
entre (*m*). These plates were connecte
ibs or flattened wires of iron (*d h*, *e i*, *f*
ormed the cradle into which the tube (
arbonate, was introduced by thrusting
sunder. Along with the tube just men
uced another tube (B) of iron or porcela
ir. Likewise, in the cradle, a pyrome

---

* I have since constantly used tubes of common
nuch too fusible for this purpose.

† The pyrometer-pieces used in these experiments
ye. Necessity compelled me to undertake this lab
n which I have already so far succeeded as to obt
hough far from complete, answer my purpose tol
n opportunity of comparing my set with that of M
emperatures, in furnaces of great size and steadiness
hat my pieces agree as well with each other as his,
emperature is indicated by a different degree of the
nabled to construct a table, by which my observati
that the temperatures mentioned in this paper
een indicated by Mr. Wedgwood's pieces. By
ean those of the only set which has been sold to
e melting heat of pure silver is indicated at the 22
hat the late Mr. Wedgwood, in his Table of F
sion as taking place at the 28th degree; but I a
rvations must have been made with some set diff
terwards sold.

placed in contact with (A) the tube containing the carbonate. These articles generally occupied the whole cradle; when any space remained it was filled up by a piece of chalk dressed for the purpose. (Fig. 4, represents the cradle filled, as just described.)

Things being thus prepared, the gun-barrel, placed erect with its muzzle upwards, was half filled with the liquid fusible metal. The cradle was then introduced into the barrel, and plunged to the bottom of the liquid, so that the carbonate was placed very near the breech (as represented in fig. 5, the fusible metal standing at *o*). The air-tube (B) being placed so as to enter the liquid with its muzzle downwards, retained great part of the air it originally contained, though some of it might be driven off by the heat, so as to escape through the liquid. The metal being now allowed to cool, and to fix round the cradle and ramrod, the air remaining in the air-tube was effectually confined, and all was held fast. The barrel being then filled to the brim with fusible metal, the apparatus was ready for the application of heat to the breech (as shown in fig 6).

In the experiments made at this time, I used a square brick furnace (figs. 7 and 8), having a muffle (*r s*) traversing it horizontally and open at both ends. This muffle being supported in the middle by a very slender prop, was exposed to fire from below, as well as all round. The barrel was placed in the muffle, with its breech in the hottest part, and the end next the muzzle projecting beyond the furnace, and surrounded with cloths which were drenched with water from time to time. (This arrangement is shown in fig. 7.) In this situation the fusible metal surrounding the cradle being melted, the air contained in the air-tube would of course seek the highest position, and its first place in the air-tube would be occupied by fusible metal. (In fig. 6., the new position of the air is shown at *p q*.)

At the conclusion of the experiment the metal was generally removed by placing the barrel in the transverse muffle, with its muzzle pointing a little downwards, and so that the heat was applied first to the muzzle, and then to the rest of the

e barrel in succession. (This operation is
some of the first of these experiment
dle by plunging the barrel into heated b
ution of muriate of lime, which last
ure of 250° of Fahrenheit before it boils
se I used a pan three inches in diamete
ep, having a flat bason at top to receive t
iled over. The method answered, but
d I laid it aside. I have had occasion lat
ume it in some experiments in which
ence to open the barrel with the least pos
By these methods I made a great numbe
th results that were highly interesting in
siness, though their importance is so mu
subsequent progress of the investigatio
per to mention but very few of them.

On the 31st of March 1801 I rammed
unded chalk into a tube of green bottle-
n the cradle as above described. A
ffle along with the barrel indicated 33°.
osed to heat during seventeen or eighte
hdrawing the cradle, the carbonate was
ss, which had visibly shrunk in bulk,
hin the tube being accurately filled w
ted the carbonate all over without pe
st, so that the metal was easily removed.
uced from forty to thirty-six grains.
y hard, and resisted the knife better tha
d previously obtained; its fracture was
a resemblance to white saline marble;
d a decided semitransparency, a circu
ved in this result.

On the 3d of March of the same year

In many of the following experiments lead wa
ble metal, and often with success; but I lost ma
: for the heat required to liquefy the lead, appr
, that it is difficult to disengage the cradle with
re by which the carbonate is injured. I have fo
ound the cradle and a few inches of the rod with
he rest of the barrel with lead.

experiment, in which a pyrometer-piece was placed within the barrel, and another in the muffle; they agreed in indicating 23°. The inner tube, which was of Reaumur's porcelain, contained eighty grains of pounded chalk. The carbonate was found, after the experiment, to have lost 3½ grains. A thin rim, less than the 20th of an inch in thickness, of whitish matter, appeared on the outside of the mass. In other respects the carbonate was in a very perfect state; it was of a yellowish colour, and had a decided semi-transparency and saline fracture. But what renders this result of the greatest value is, that on breaking the mass a space of more than the tenth of an inch square was found to be completely crystallized, having acquired the rhomboidal fracture of calcareous spar. It was white and opake, and presented to the view three sets of parallel plates which are seen under three different angles. This substance, owing to partial calcination and subsequent absorption of moisture, had lost all appearance of its remarkable properties in some weeks after its production; but this appearance has since been restored by a fresh fracture, and the specimen is now well preserved by being hermetically inclosed.

[To be continued.]

XXV. *Additional Experiments and Remarks on an artificial Substance which possesses the principal characteristic Properties of Tannin.* *By* CHARLES HATCHETT, *Esq. F. R. S.*

[Concluded from p. 68.]

§ VII.

FROM the experiments which have been related, it appears, that three varieties of the artificial tanning substance may be formed, viz.

1st, That which is produced by the action of nitric acid upon any carbonaceous substance, whether vegetable, animal, or mineral.

2dly, That which is formed by distilling nitric acid from common

mmon resin, indigo, dragon's blood, ar
bstances: and,

3dly, That which is yielded to alcohol by
mi, asa fœtida, camphor, &c., after tl
en for some time previously digested with

Upon these three products I shall now
rks, which I have hitherto postponed, i
count of the experiments might not be in

The first variety is that which is the mos
d from some experiments which were p
d that 100 grains of dry vegetable char
tanning substance; but, as it is extrem
tely to expel moisture, or even the wh
d which has been employed*, an allowan
four grains ought to be made; so that af
may conclude, that 100 grains of vegeta
6 or 117 of the dry tanning substance.

The proportions of the constituent parts
ave not as yet ascertained; but, from
ich it is produced, carbon is evidently tl
the predominating essential ingredient.

From § III. experiment F. it also appea
mponent parts are oxygen, hydrogen, a
en the artificial tanning substance was d
d carbonic acid were obtained, exclusi
tion of a yellow liquor, which stained
retort, and which, from its tenacity a
ter and alcohol, appeared to be of an oil

As I had taken every precaution respe
ich had been employed, I was at first ir
above facts as almost positively demons
nce of hydrogen in charcoal; but upon
d upon weighing some of the circumsta
formation of the artificial tanning sub
this point very considerable doubt; for

---

* The most effectual method of expelling the nitr
ing substance to powder, and repeatedly evapora
illed water from it in a glass or porcelain basin.

observed, that diluted nitric acid acts upon charcoa more effectually in the formation of the tanning substance than when it is employed in a concentrated state; and it appears therefore very probable that hydrogen may have been afforded by a portion of water decomposed during the process. For, admitting that the new compound (formed by the action of nitric acid upon charcoal) may possess a certain degree of affinity for hydrogen, this, being exerted simultaneously with the affinity for oxygen possessed by nitrous gas, may (especially when the last is in a nascent state) effect a decomposition of a portion of water, the hydrogen of which would therefore enter into the composition of the tanning substance, whilst the oxygen would supply the place of part of that which had been taken from the nitric acid.

Many of the properties of the tanning substance prepared from coal by nitric acid are very remarkable, particularly those which have been noticed in § III. experiments F and G; for surely it is not a little singular, that this substance when burned should emit an odour so very similar to animal matter, notwithstanding that the tanning substance had been prepared from pure vegetable charcoal. And again, in experiment G, the portion which had not been precipitated by solution of isinglass was, when dried, found to possess a strong vegetable odour very analogous to oak bark, although charcoal is inodorous, and isinglass very nearly so.

But, after all, the most extraordinary properties of this substance are certainly those which so nearly approach it to the vegetable principle called *tannin*; for it perfectly resembles this principle by its solubility in water and in alcohol, by its action upon gelatine and upon skin, by the effects which it produces upon metallic solutions, upon those of the earths, and of the alkalis.

The sulphuric and muriatic acids also affect the solutions of it as they do those of tannin; and the only marked difference which as yet has been found in the characters of the artificial substance and of tannin is, that the former is produced, whilst the varieties of the latter are more or less destroyed by nitric acid. This, for the present at least, must draw a line of separation between them; but we must not

forget, that even the varieties of tanni
the degree of destructibility.

The second variety of the tanning s
from a great number of vegetable bod
dragon's blood, common resin, &c. &
distilling them with nitric acid. It is r
so readily prepared as that which was fir
relative quantity, when compared with t
employed to produce it, is less.

As resin and some of the other bo
until they have been repeatedly treated w
as during each operation nitrous gas is p
strength of the acid which comes ove

---

[*] I shall here venture to state some ideas which
the probable cause and mode of the formation of ta

Mr. Biggin has proved, that similar barks, when
ferent seasons, differ as to the quantities of tann
(Phil. Trans. 1799, p. 259.)

Mr. Davy also observes, "that the proportions of
in barks vary considerably according as their age a

"That in every astringent bark the interior whit
next to the alburnum) contains the largest quantity
tion of extractive matter is generally greatest in the
but the epidermis seldom furnishes either tannin or

Moreover Mr. Davy remarks, "that the white c
ratively most abundant in young trees, and hence t
same weight a larger proportion of tannin than th
(Phil. Trans. 1803, p. 264.)

We find, therefore,

1st, That the proportion of tannin in the same tre
seasons.

2dly, That tannin is principally contained in the
interior white bark, which is next to the alburnum

3dly, That these white cortical layers are com
in young trees, and that their barks consequently c
more tannin than the barks of old trees.

I shall not make any remarks on the first of these
other similar effects, which are the natural consequ
periods of vegetation; but the second and third
for they prove that tannin is principally formed, o
interior white bark, which is next to the alburnum
the very same part where the successive portions o
borated and deposited, we find the principal portio

It should seem, therefore, that there is an intima seems almost evident that this tanning substance is formed in consequence of part of the oxygen of the nitric acid becoming combined with the hydrogen of the original body, so as to form water; and the carbon, being thus in some measure denuded, is rendered capable of being gradually acted upon by the nitric acid in a manner nearly similar to that which takes place when it has been previously converted into coal.

The colour of the precipitates which this tanning substance yields with gelatine is constantly pale or deep yellow, whilst that of the precipitates formed by the first variety is always brown; I am therefore induced to believe that the different colours of the precipitates produced by the varieties of tannin depend on the state of their carbon.

When resin and the other bodies were treated as above described

---

formation of new wood and the formation of tannin in such vegetables as afford the latter; and this idea is corroborated when the chemical nature of these substances is considered.

From experiments made on the ligneous substance of vegetables, or the woody fibre, it appears to be composed of carbon, oxygen, hydrogen, and nitrogen; but of these its principal and essential ingredient is carbon.

In like manner carbon is unquestionably the basis and principal ingredient of tannin. Considering, therefore, that both of these substances consist principally of carbon; that tannin is secreted in that part of barks where the formation and deposition of new wood take place; and that the quantity of tannin is the most considerable in young trees, and seems therefore to keep pace with their more vigorous growth, and consequent rapid formation of wood; it appears very probable that those vegetables which contain tannin have the faculty of absorbing more carbon and of the other principles than are immediately required in the formation of the different proximate vegetable substances, especially the woody fibre: that this excess, by chemical combination, becomes tannin, which is secreted in the white interior bark: that in this state it is a principle peculiarly fitted to concur by assimilation to form new wood: that it is therefore subsequently decomposed at the proper period, and is employed in the formation of the new wood: that there is not a continual accumulation of tannin in the vegetables which afford it, as it is successively formed in and with the white cortical layers, and is successively decomposed by concurring to form new wood: and, lastly, that as the vegetable approaches more nearly to the full maturity of its growth, when wood is less rapidly and less plentifully formed, so in like manner less tannin is secreted; for, the fabric being nearly completed, fewer materials are required.

Such I am inclined to suspect, from the facts which have been adduced, to be the cause and mode by which tannin is formed in oaks and other vegetables; but I make this statement only as a probable conjecture, which may be refuted or confirmed by future observations.

orget, that even the varieties of tannin[*]
he degree of destructibility.

The second variety of the tanning sub
rom a great number of vegetable bodies
ragon's blood, common resin, &c. &c.,
istilling them with nitric acid. It is not
o readily prepared as that which was first
elative quantity, when compared with tha
mployed to produce it, is less.

As resin and some of the other bodie
ntil they have been repeatedly treated wit
s during each operation nitrous gas is pro
trength of the acid which comes over i

---

[*] I shall here venture to state some ideas which h
e probable cause and mode of the formation of tanni
Mr. Biggin has proved, that similar barks, when ta
rent seasons, differ as to the quantities of tannin
Phil. Trans. 1799, p. 259.)

Mr. Davy also observes, "that the proportions of th
barks vary considerably according as their age and
" That in every astringent bark the interior white b
xt to the alburnum) contains the largest quantity of
n of extractive matter is generally greatest in the m
t the epidermis seldom furnishes either tannin or ext
Moreover Mr. Davy remarks, " that the white cor
tively most abundant in young trees, and hence the
me weight a larger proportion of tannin than the
hil. Trans. 1803, p. 264.)

We find, therefore,

1st, That the proportion of tannin in the same trees
asons.

2dly, That tannin is principally contained in the v
erior white bark, which is next to the alburnum or

3dly, That these white cortical layers are compa
young trees, and that their barks consequently con
re tannin than the barks of old trees.

I shall not make any remarks on the first of these f
ner similar effects, which are the natural conseque
riods of vegetation; but the second and third a
they prove that tannin is principally formed, or
erior white bark, which is next to the alburnum
e very same part where the successive portions of
rated and deposited, we find the principal portion
It should seem, therefore, that there is an intimate

seems almost evident that this tanning substance is formed in consequence of part of the oxygen of the nitric acid becoming combined with the hydrogen of the original body, so as to form water; and the carbon, being thus in some measure denuded, is rendered capable of being gradually acted upon by the nitric acid in a manner nearly similar to that which takes place when it has been previously converted into coal.

The colour of the precipitates which this tanning substance yields with gelatine is constantly pale or deep yellow, whilst that of the precipitates formed by the first variety is always brown; I am therefore induced to believe that the different colours of the precipitates produced by the varieties of tannin depend on the state of their carbon.

When resin and the other bodies were treated as above

---

formation of new wood and the formation of tannin in such vegetables as afford the latter; and this idea is corroborated when the chemical nature of these substances is considered.

From experiments made on the ligneous substance of vegetables, or the woody fibre, it appears to be composed of carbon, oxygen, hydrogen, and nitrogen; but of these its principal and essential ingredient is carbon.

In like manner carbon is unquestionably the basis and principal ingredient of tannin. Considering, therefore, that both of these substances consist principally of carbon; that tannin is secreted in that part of barks where the formation and deposition of new wood take place; and that the quantity of tannin is the most considerable in young trees, and seems therefore to keep pace with their more vigorous growth, and consequent rapid formation of wood; it appears very probable that those vegetables which contain tannin have the faculty of absorbing more carbon and of the other principles than are immediately required in the formation of the different proximate vegetable substances, especially the woody fibre: that this excess, by chemical combination, becomes tannin, which is secreted in the white interior bark: that in this state it is a principle peculiarly fitted to concur by assimilation to form new wood: that it is therefore subsequently decomposed at the proper period, and is employed in the formation of the new wood: that there is not a continual accumulation of tannin in the vegetables which afford it, as it is successively formed in and with the white cortical layers, and is successively decomposed by concurring to form new wood: and, lastly, that as the vegetable approaches more nearly to the full maturity of its growth, when wood is less rapidly and less plentifully formed, so in like manner less tannin is secreted; for, the fabric being nearly completed, fewer materials are required.

Such I am inclined to suspect, from the facts which have been adduced, to be the cause and mode by which tannin is formed in oaks and other vegetables; but I make this statement only as a probable conjecture, which may be refuted or confirmed by future observations.

scribed with nitric acid, the quantity obt
ng substance was much less than when a
coal was employed, or even when these
eviously converted into coal in the humid
id.

The cause of this seems to be, that a
oducts are simultaneously formed, all o
ore or less of carbon as a constituent ing
consequence of the affinities which pr
isting circumstances, some bodies by
ric acid afford but little, and others none
bstance.

The greatest proportion of this substanc
ligo, common resin, and stick lac.

The quantity obtained from asa fœtida and
s less.

Benzoin, balsam of Tolu, balsam of Pe
od, were inferior to the former in this
development, or rather production of be

The expression "production of benzoic acid" may
I shall therefore take this opportunity so observ
present established opinion respecting the balsams a
neous: for the balsams are defined as bodies comp
acid; consequently the latter, when obtained in a
d as an original ingredient or educt.

am, however, inclined to a contrary opinion; for I
eculiar substances, which, although nearly approa
ns, are nevertheless different in respect to the o
r elementary principles; which combination, howe
modified by various causes, and especially by a ce
ature, so that a new arrangement of the elementary
t being formed into resin, and part into benzoic ac
Many facts appear more or less to support this opin
acid is obtained by simple sublimation, or by m
oiling water, according to Geoffroy's method, or b
ecommended by Scheele, or by employing alkalis
hing positive can be inferred from any of these o
zoic acid is obtained as an educt, but rather the
on the affinities which are most likely to prevail
he different processes, and on the variable prop
; and although benzoic acid has been discovered
hat of many adults, and constantly in that of gra

peared partly to counteract the formation of the tanning substance; but oxalic acid, when formed in any considerable quantity, seemed absolutely to prevent the formation of this substance; for whilst abundance of the former was obtained from gum arabic, tragacanth, manna, and guaiacum, not any of the latter could be produced.

Common liquorice appears at first to be an exception; but from the smallness of the quantity, and the colour of the precipitate which it produced with solution of isinglass, I am almost convinced that the tanning substance was formed by the action of the nitric acid on a portion of uncombined carbon, which, being in a state approaching to coal, is probably the cause of the blackness of the common liquorice.

As the formation of the tanning substance has been my

---

such as the camel, the horse, and the cow, (*Système des Connoissances Chimiques*, par Fourcroy, 4to edit. tom. iv. p. 158;) yet all this certainly appears to be in favour of its being a chemical product.

I have observed, when benzoin, balsam of Tolu, and balsam of Peru, were dissolved in sulphuric acid, that a great quantity of beautifully crystallized white benzoic acid was sublimed during digestion; and as it is produced in so very pure a state by this single and simple operation, I would recommend a trial of the process to those who prepare benzoic acid for commerce; but I am not certain whether this mode may prove more œconomical than those which at present are employed.

When dragon's blood, however, was treated in the same manner with sulphuric acid, I could not obtain a particle of benzoic acid; nor did I succeed much better when I had recourse to lime, according to Scheele's process; for, although a considerable quantity of the substance was thus rendered soluble in water, yet by the addition of muriatic acid I obtained only a slight appearance of benzoic acid, accompanied by a copious precipitate of red resin, notwithstanding that the solution had acquired a powerful and peculiar balsamic odour.

But in a former part of this paper I have stated, that when dragon's blood was dissolved in nitric acid, and afterwards evaporated to dryness, it yielded about 6 per cent. of benzoic acid. Now, if this had been originally present in dragon's blood in the state of benzoic acid, some stronger evidence of it might reasonably have been expected in each process; but this not being the case, I am inclined to consider it as produced, and not educed, by the action of the nitric acid on the original principles of the dragon's blood; and I am also persuaded that similar but more general effects take place when benzoin or any of the balsams are subjected to the different processes by which benzoic acid is obtained; so that to me this last seems to be as much a chemical product as the oxalic, the acetous, and other of the vegetable acids.

The succinic acid also appears to be a product and not an original ingredient of amber.

principal

incipal object, I have not thought it nece
esent into too minute a detail of other part
erefore only thus cursorily noticed some
fects produced by nitric acid on the resi
hose, however, who are conversant with
ndoubtedly perceive that these effects de
tely investigated; and that the resins, balsa
nd gums, should be regularly examined b
ethod, not merely on account of the indiv
hich may become the subjects of experim
ere is reason to expect that from such
edicine, with the arts and manufactures, r
vantages, whilst the mysterious process
getation may very probably receive cons
on.

Concerning the third variety of the ta
hich is produced by the action of sulp
sins, gum resins, &c., I shall here add
hich I have already stated in the latter p
ction of my first paper, and in the acco
tely given of an experiment on camphor.

This variety appears to be uniformly
rtain period of the process, but by a lo
e digestion I have reason to believe that i
Substances, such as the gums, which a
id by treatment with other acids, do n
y of this tanning substance.

The energy of its action on gelatine and
ferior to that of the first variety, into w
e have seen, it may easily be converted
From the mode of its formation there
any positive evidence that it contains
st and second varieties, and perhaps th
n may be the cause of its less powerful
t as yet ascertained, but it is my inten
ly to notice in a future paper the gene
bstance.

XXVI. *A simple and accurate Mode of constructing Gasometers for Purposes where uniform Pressure is essential, by the Application of the Hydrostatic Regulator.* *By* JOSEPH STEEVENS, *Esq.*

To Mr. Tilloch.

SIR,

I HAVE herewith sent you a drawing and description of a gasometer constructed on the principle of my hydrostatic regulator, described in your twentieth volume, page 289, which, I conceive, will be found fully as useful as the most complex and expensive instrument of this kind that has yet been produced. I have endeavoured to be brief in my description, as the reader will easily comprehend the uses and modes of employing the instrument from the descriptions you have already published of other gasometers, and of the hydrostatic regulator already referred to.—I am, sir,

Your obedient servant,
JOSEPH STEEVENS.

Garlic Hill,
March 8, 1806.

A tin vessel, A, (Plate V.) of 12 inches diameter and 12 inches deep, is supported by four pillars *p, p, p, p* fixed at the top into the circular piece of wood *m, m,* and at the bottom into the wood base *q q* about an inch and a half thick, and hollowed out in the middle to receive the convex surface of the vessel B, on which it is fixed by means of the loops and hooks *o, o, o, o*: through the base *q q* two holes are made to allow the cocks *g c* to pass, for readily removing B for the purpose of filling, &c., though by having a cock near the bottom it may be filled in its present situation. The vessel B is about 13 inches diameter and 10 deep. *d* is a collar of leathers fixed to the vessel A, through which a metal tube *d e* passes, extending down the tube *f g* to *e*. To the cock *g* a recurved tube is fixed, and so bent that it returns and nearly touches the upper part of the gas-holder B. A slip of metal may be placed diagonally under this tube, to prevent the noise of the water while running from A to B. The vessel A being filled with water, and B with gas, in the usual

l manner, (for B is no more than the
er,) screw in the collar *d*, shut the cock *c*
vater will run in until the density of the
e of resisting its effective pressure, which
tly equal to a column of water whose hei
height of the orifice *e*, of the tube *de*, ab
rved tube in the vessel B: for as the air i
el A has to counteract a column of wat
h *e* below the surface, so will the gas in
the whole column, minus that part of it a
rincumbent column above *e* has no share
ch may be increased and decreased at p
ng and depressing *e*, without regard to
r in A, and which pressure will continu
water subsides to the level of the orifice
tion of my hydrostatic regulator, Phil.
89.

rom the facility with which the pressu
er may be altered, it becomes a very us
ll cases where the blowpipe is used;
ged with oxygen gas for the purpose o
eoxidating metals, the combustion of t
r experiments where intense heat is re
it is charged with atmospheric air for
ing, soldering, or the like. It will also
illing vessels for a variety of experimen
nistry, as well as for playing jets of
, provided with a jet capable of being
e to the horizon, be fixed into the tube
tube *de* so elevated that the orifice
in the bottom of the vessel A, a use
aratus will be formed for illustrating the
rojectiles; for, as the pressure and efflu
zontal ranges will be equal at equal a
w 45°, and the curve described distin
d. An instrument of this kind has
Mathematical Society's present course
ow in their repository.

XXVII. *Process employed to obtain a Black Liquid, invented by Mr.* Clarke, *an Englishman, and introduced into Commerce; its Use in marking Linen in a solid and durable Manner, and its Application for printing Cottons or Stuffs. By M.* Hermbstadt, *of Berlin.*

For these two or three years past, a black tincture has been sold for the purpose of marking linen.

A glass polisher and directions for using the tincture accompany the two bottles which contain the ingredients, and the whole is sealed up in a case.

One of the bottles contains the mordant. The other contains the ink, which is of a deep brown colour, and which must be well shaken before making use of it, because it subsides when left to rest.

The part of the linen intended to be marked must be in the first place impregnated with the mordant, which is allowed to dry on the linen. The place which had been wetted is then rubbed with the polisher; an ordinary pen is then dipped in the ink, and the writing is performed on the linen the same as on paper. Neither soap nor any chemical preparation will destroy this writing, which, when well dried, is of a very fine black.

Having chemically analysed these two liquids, I am able to give an account of the ingredients which compose them.

Preparation of the Ink.

Dissolve in nitric acid (aquafortis) what quantity of silver you please. This solution, if the silver has been alloyed with copper, will be of a sapphire blue.

In order to separate the copper from the silver add to the solution twelve times its weight of distilled water, or, for want of it, rain water, and suspend in it a thin plate of copper. In proportion as this plate dissolves, the silver will precipitate itself, perfectly pure, in the form of a white powder. When no more of this powder will precipitate itself, the liquor should be decanted. The powder is then washed in a great quantity of water, until the water thrown upon it

is

is no longer of a blue cast, but remain
The residue, *i. e.* this powder, well dried,
purest state.

If this residue weighs one ounce, diss
senegal and two drachms of white glue
distilled water. Mix this solution with
lamp-black well calcined in a close crucib

To manufacture this mixture properly,
turated in a glass mortar.

This operation being finished, the sol
luted in eight times its weight of distille
upon the above mixture: the whole is the
a spatula, and the ink is made.

Preparation of the Morda

Dissolve two ounces of white glue and
in six ounces of alcohol and as much dist
solution will be made in two days. The
of for the purpose; and care must be ta
kinds of glue from time to time.

After the whole is dissolved, it must
flannel, in order to keep back all its muc
The liquid thus filtered, and preserved in a
is then ready for use.

Manner in which the Ink

The solution of silver in the nitric
than the composition of the *lapis inferm*
knows its properties in staining the ski
black colour. If the linen or stuff is firs
the above mordant, which is an animal
may be afterwards applied without spreac
pletely dye every thread of the part to
the mordant having previously partly ani
the fabric.

Soap, or any other ingredient used in
erate the lamp black, but it never tak
silver; and the object proposed is the
attained.

Application of the Ink for printing orange Cotton and other Stuffs.

We may easily conceive that this ink may be employed with advantage for printing cloths of a white, yellow, or rose ground, or any other clear colour.

The cloths or stuffs intended to be printed in this manner, require no other preparation than to be dipped in a solution of parchment or isinglass; and after they are dried they must be rubbed with a glass polisher.

The ink must be thickened for this purpose with a greater quantity of gum senegal, and then applied upon the cloths or stuffs in the usual manner by means of wooden or metal stamps.

Three or four days after this operation the stuffs must be first washed with a great quantity of clear water, and afterwards with soap and water, which will make them appear of a finer black.

XXVIII. *Letter of Messrs.* CIVNI *and* PETRINI *to Professor* PACCHIANI, *of Pisa, on the supposed Production of Muriatic Acid by Galvanism* *.

WHEN professor Simon †, by insulating the action of the positive pole of the electrical column under water, obtained oxygen gas and an acid as the result of his analysis; and when he recognised in this acid all the characteristics of the muriatic acid, he supposed that it might be produced by the muscular fibre which he had substituted in the place of the metal wire communicating with the negative pole of the column; and he went no further than imagining that he had only obtained a result new, interesting, and agreeing extremely well with the most luminous facts of pneumatic chemistry.

It was reserved for you to trace this result a little further; and your repetition of the experiment produced this new and

---

* Abridged from *Annales de Chimie*, tome lvi. p. 269.

† *Annales de Chimie*, tome xli. p. 106.

important

portant truth—“ *that hydrogen is suscept*
rees of oxygenation.”

The discovery of the nature of the muriati
ncide with that of the different degrees of
ich hydrogen is susceptible.

“ Of all the substances known,” says the
llet in his Chemical Statics, “ there is
h the exception of hydrogen, which, at a
 combine with a greater quantity of oxyg
racteristic properties disappear, while tl
f also loses the properties which charact
ts prove that the acid property required to
nate quantities of alkali, is not in proporti
 of oxygen which combines with a bas
re it is condensed, the stronger, in con
ion which it evinces; the less it gives
al quantity, because the free acid propert
nicates by its affinity is diminished in con
ion. Thus water, exhibiting neither the
 nor of hydrogen, we may conclude tha
nces are combined at the term where the
rcises the greatest effect, and when the
te to that of a neutral salt, in which the
perties are equally become latent; ha
their combination a condensation by whi
uced to 0·0002. In the acids the qualiti
l; in inflammable liquids those of hydro
t in such a manner, that in the first
gen experiences a degree of saturation l
l in the latter it is the hydrogen which i

After this opinion of one of the most ce
Europe upon the phænomena relative to
oxygen, we need be no longer surprised
 passing, in your experiments, to a st
ndoning a part of the oxygen which sat

We render homage to truth in adopting
n the decomposition of water by mean
iter. They coincide too exactly with tl
les of the “ Chemical Statics” to doubt

Occupied in repeating some experiments concerted with you, we were anxious to determine the proportions of the elements of the muriatic acid. We introduced into a glass tube, intended to contain the water which was to pass to the state of muriatic acid, a solution of carbonate of soda or of potash. We closed the upper extremity of the tube, which was traversed by a gold wire communicating with the positive pole of the column by a crooked capillary tube, which entered under a little bell glass filled with a solution of caustic soda, and inverted in a little cup containing the same liquor.

The oxygen, which liberates itself from the water, determines the production of a certain number of particles of muriatic acid, which take the place of a greater or less quantity of particles of carbonic acid in the carbonate of potash or soda according to the amount of their capacity of saturation. The oxygen gas and the carbonic acid gas pass through the tube into the bell glass of the pneumatic apparatus; and this latter, absorbed by the caustic soda, leaves the oxygen gas alone. It is evident that the neutral muriate of soda or of potash contained in the tube which transmits the electrical fluid (and which may be easily separated from the carbonate of soda or of potash that may remain there, by decomposing the latter by the acetic acid, and taking up the acetate by means of alcohol) indicated the quantity of muriatic acid which was there formed, while the air which may pass into the bell glass of the pneumatic apparatus announced the quantity of oxygen which a mass of water, equal to the amount of the weight of the acid formed, and of the oxygen gas obtained, must lose in order to be converted into muriatic acid.

The same results may be obtained by a method much simpler and more rigorous, by substituting in the pneumatic apparatus mercury in the place of caustic soda. In this case, a mixture of carbonic acid and oxygen gas will be obtained in the bell glass of the apparatus; and when the quantities of soda or potash which the carbonic and muriatic acids require for their saturation are exactly known, the quantity of carbonic acid gas liberated necessarily indicates that of the muriatic acid, which has assumed its place in the

tube through which the elastic fluid pass
riate of soda or of potash. We have reduc
formula the general expression of the res
riments of this kind. If, for example,
necessary to neutralise the potash or so
bonic acid is a quantity expressed by m,
gen gas obtained is represented by n,
weight of the water decomposed, which
thus if the oxygen contained in P equal
oxygen which contains m is equal to 0·8

XXIX. *On the Decomposition of Wat*
By JOHN CUTHBERTSON,

To Mr. Tilloch.

DEAR SIR,

I HAD, by some means, overlooked that
valuable Magazine (vol. xxiv. p. 285.) w
you had been informed that I had repe
on the composition of muriatic acid by
not know you had mentioned it till I was
an apparatus as you had mentioned.
however, was not perfectly correct:—I
riment, but did not intend it for publi
peated it in a more accurate manner;
what would be the consequence when
performed in such an incorrect manner
be able to repeat. The water which I us
intending, if I found at the terminatio
the remaining water to possess any o
that which it had before the process, to
encouragement to undertake an accurate
during the process that the gold wire let
something that had the appearance of p
metal, and the wire appeared at places
platina wire let fall a small white clou
process. When one-half of the water
remaining portion, by the usual tests, s

dity. Two days before the experiment ended, I placed that end of the tube which had the gold wire at the upper end of the trough, and very soon the platina which had remained bright became black, and, when magnified, had the appearance of black powder covering its surface, from the end to the height of the gold wire. The glass tube was in the form of the sketch sent herewith (Plate V. fig. C.) The lines on the inside represent the two wires; *a b* the gold wire, and *c d* the platina wire.

This result made a repetition necessary in a more accurate manner. Accordingly, I took another clean glass tube bent in the same form, but I substituted, instead of the gold wire *a b*, a platina wire, so that both wires were of the same metal, and introduced distilled water. After this apparatus had stood with its end *a* in connection with the zinc end of the trough three days, the short platina wire assumed the colour of gold, and the long one began to grow black from the lower end to the height of the short wire, and continued so for the space of three weeks. When about one-third of the water had disappeared, I connected the lower end of the tube with the copper end of the trough, and in the space of one day the black powder left the long wire perfectly bright, and the short one became black. In the space of two days that portion of the long wire to the height of the short one obtained a yellowish gold-like tinge. Both remained so for three days; when I placed them in their first situation: the black powder left the short wire, and the long one became black I immersed in the remaining water a slip of blue test paper; the colour was changed; so that I make no doubt but that, when the operation is continued till half the water disappears, it will give as strong signs of acidity as the former.

You will observe that the ends of the wires are placed parallel to each other; I found that situation to be most favourable to the production of gas: perhaps, if they were placed with their ends opposite each other, the change of colour would not take place.

I am respectfully yours,

JOHN CUTHBERTSON.

No. 64, Poland-street,
March 22, 1806.

XXX. No-

XXX. *Notice of Experiments made by the* *of Paris on the Discovery announced b* *of the Composition of the Muriatic Acid*

As soon as the Galvanic Society was infor
hiani announced that he had obtained muri
rom water a part of its oxygen, the society'
ected to endeavour, as well by means of ele
anism, to confirm this discovery so impor

M. Pacchiani having solely employed t
he members determined to employ in
he same agent, in that manner which app
nost convenient and proper; and, above
ive results the least susceptible of objecti

First Experiment.

They took a piece of new glass tube
eter in length, and 0·009 parts of a met
eter. One of the ends of this tube was c
the other a capillary tube was joined (b
s to come under a bell glass. At the
ibe, and at an equal distance from the j
illary tube, two holes were punctured a
he solid glass, by means of which apert
erted into the interior of the tube, at a
rom its lower extremity, two bits of gold
rd 0·976 purity, and about 0·0005 parts
eter, disposed so as not to touch each
ear against the inside of the tube. T
fterwards closed by the lamp. The tub
ddition was filled with pure distilled wat
xed with bees' wax upon a piece of gl
iddle of a horizontal Galvanic pile of
lates of 0·108 parts of a meter each
ere separated by bits of leather, the inter
ere filled up with very pure sand moist
f muriate of soda. The capillary tub

---

* From *Annales de Chimie*, tom

tub of water, its extremity entered below a bell glass filled with the same fluid. The two gold wires being then placed in communication with the two poles of the pile, its activity was immediately manifested by the disengagement of gas in a string of very perceptible bubbles coming from the inferior extremity of each of the gold wires, but in a much greater quantity from that connected with the copper pole. The pile was kept in action, with very little interruption, from the 8th Thermidor to the 11th of the following month. After any interruption whatever, the activity was immediately reproduced by the agitation of the wires communicating with the poles of the pile. It was also remarked that the activity of the pile was constantly stronger from mid-day till four o'clock, when it began to decline. On the 11th Fructidor the apparatus was dismounted, after having been during 34 consecutive days in action, and in an activity of disengagement which may be considered as having been continual. The water was then diminished by one-half its volume. It had lost nothing of its limpidity. The extremities of the gold wire, from which the disengagement of the gas took place in the interior of the tube, were oxidated; the one corresponding with the zinc pole of the pile was most oxidated. The whole of the gas obtained and collected during the experiment was about 793 cubic centimeters. The liquid remaining in the tube was examined with care. It produced no kind of taste upon the tongue, nor any action on tinctures of turnsole and brazil-wood, nor with the solution of nitrate of silver.

The society proceeded afterwards to the trial of the gases disengaged by the action of the pile. After having introduced one measure of it into the eudiometer of Fontana, they made pass into it an equal quantity of nitrous gas made expressly for this experiment. There was an absorption of 77 two hundredth parts upon the volume of the two measures. In order to ascertain if by this absorption all the oxygen the gases contained had entered into combination, a second measure of the same nitrous gas was introduced into the eudiometer after this absorption. It experienced no diminution of volume. They tried to estimate by comparison

the quantity of oxygen which coul
produced by the introduction of th
gas, by trying atmospheric air in t
consequently introduced one measur
one of the same nitrous gas. Th
hundredth parts. By considering
fect of the combination of the nitr
of oxygen gas corresponding to 0·2
contains of it, they concluded that
two hundredth parts, produced wit
presented proportionally the combin
gas, with a little less than 0·31 of o
served that, the measures of the g
and successively introduced into t
have happened that they were not
together, and that, consequently, t
be complete. It was thought mor
gases pass at first by separate mea
and afterwards to introduce the wh
the eudiometer. The preceding e
repeated in this manner, there was,
and the nitrous gas, an absorption o
in place of 77 resulting from the
mode; and with atmospheric air an
the absorption was 68 two hundre
there results from it always in the sa
oxygen contained in atmospheric ai
tion of about 0·30 of this gas in tha
again with the eudiometer of Volta
measure through which the electric
the trial was repeatedly made upon t
sures, and always the absorption r
mation by the electric spark gave
about 0·30 of oxygen.

Second Experim

Two grammes of distilled water w
bent in the manner of a syphon. T
commerce, of about 0·0002 parts of

introduced into this tube, plunging them into the water at about 0·006 parts of a meter distant the one from the other. This tube was placed upon a horizontal pile of fifty double plates of about 0·081 parts of a meter in dimension upon each side. The intervals were filled with dry sand, moistened with river-water acidulated with about a sixtieth part of nitric acid. The gold wires having been placed in communication with the two poles of the pile, the water in the tube assumed, from the first day, a reddish brown colour upon the side of the copper pole, and the wire which joined it was covered with a coating of a deep brown oxide of gold. The wire corresponding with the zinc pole did not assume the same colour. The gold was gradually dissolved, and was precipitated, as well as a portion of the silver alloy. This precipitate presented to the magnifying glass, upon almost the whole length of the tube, needle-formed crystals. The wire corresponding with the zinc pole was entirely cleared of the gold which it contained, and it was now nothing else than a silver wire of extreme tenuity. There was very little gas disengaged from either extremity of the wires. The water was only diminished a fifth part of its volume. The pile was in full activity from the 28th Messidor to the 8th Fructidor: it still indicated to the last day, by means of the electro-micrometer (simplified and perfected by one of the members of the society upon the one constructed in Germany, described in the *Journal de Physique* for the month of Messidor, year 13), a tension of 840 degrees. The liquid residue presented with the different re-agents no mark of acidity, it only had a metallic taste.

The Galvanic Society, by examining principally the results of the first experiment, as relating more particularly to the fact announced by M. Pacchiani, considered that, by keeping account of the small quantity of oxygen which had produced the oxidation of the extremities of the gold wire, they might estimate the total quantity of oxygen contained in the gas of the pile; and, as they found it very nearly in the same proportion that oxygen gas enters into the formation of water, the society believed they might conclude that the only effect of the action of the Galvanic pile, during the whole continuance of the experiment, had position of a portion of the water employ ration, in a pure state, of the oxygen an f which it was formed. The society is nion, that M. Pacchiani is deceived respec he acid which he announced he had obta cid may have come from some animal tance employed in his apparatus. They leclare that to the apparatus employed b give the preference, as the simplest and n any foreign influence; and they do not bel ible to produce any thing by the action oile, except the decomposition of a great ion of the water submitted to its action.

XXXI. *Extract of a new Letter of D* CHIANI, *Professor of Natural Philosop sity of Pisa, to M.* FABRONI, *upon t the Muriatic Acid**.

THE efforts which the best naturalists h o explain in what manner water is decc f the electrical column, and to give an ision, of the important questions which ubject, demonstrate that the principles et out, in order to attain their object, rom being an immediate result of facts nd that they were given to the public w nductions of science.

When hypotheses are established by a ot perplex the mind of the philosoph ertainly will be of great assistance to l fter truth; but when they are too hastil iples, instead of aiding the judgment, isplaying itself, and arriving at those su re the object of its labours.

---

* From *Annales de Chimie*, tom

I have already sufficiently indicated the method I followed in order to generalize the results I announced; and I have demonstrated that not only gold and platina, but all the metals and metallic bodies, in short all substances proper for decomposing water, as soon as they are traversed by an electrical current strong enough to disengage oxygen, have the property of converting water into oxygenated muriatic acid. This change of nature, this metamorphosis (if I may be permitted so to express myself) of water, fills with astonishment the philosopher who contemplates it, and who comprehends the useful consequences which may be derived from it.

For a long time I have been occupied with this subject, and this result enters into the course of experiments which I made and communicated to M. Viltosio Fossombroni. But have the people who repeated my experiments read my letters with a tranquil spirit, laying aside all the hypotheses already received? Did they make use of the method which I indicated?—Certainly not.

My assertion is so true; that some celebrated chemists, in spite of what I observed in my letters, introduced into the apparatus two metallic wires, making one of them communicate with the positive pole, and the other with the negative pole of the electrical column. How is it possible to obtain, by such a method, the conversion of the water into oxygenated muriatic acid? It is a fact recognised by every naturalist, that the wire which communicates with the positive pole disengages pure oxygen, while the other which communicates with the negative pole disengages from the water very pure hydrogen; it is likewise equally obvious, that the two gases into which the water gradually converts itself, develop themselves in such a proportion, that if they lose their elasticity they will again recompose the same volume of water, equivalent in weight to that of the two gases.

I ask, at present, How, after these facts, it could be pretended that the liquid which remains from the decomposition could convert itself into oxygenated muriatic acid? But let us proceed a step further: the moleculæ of water which are deoxygenated by the contact of the wire of the

positive pole, being deprived of their ela
they combine themselves immediately wit
culæ of water abandoned by hydrogen in t
of the wire of the negative pole of the
since they are equally deprived of elastici
self-evident : in fact, if moleculæ of oxy
deprived of elasticity, and in the necessa
form water, could enter into immediate
not form water, it would be impossible
exist at all.

These considerations did not escape the
boldt and Gay-Lussac : they understood e
in the experiment of the English chemis
not be oxygenated and hydrogenated but
ment alone ; seeing that the total absorpti
one side, and of oxygen on the other, sh
is really neither hydrogenated nor oxyge
order to become so, it would be necess
absorb one of the two gases in a propor
that required for the composition of wat
sorbs these two gases in the proportion i
to conceive that the properties of one
neutralized by those of the other, and th
the experiment quoted, the water mig
oxygenate itself for a single moment, b
remain in this state in a permanent mar
already mentioned.

But to return to our subject, which is
blem of the solution upon which the
nto oxygenated acid depends.

A volume of water, distilled and de
given, decompose it in such a manner
which it ought to clear itself graduall
oxygen.

Solution.

Take a glass tube of any form you
t has two orifices, the one small and r
a diameter large enough to introduce the
ble : through the first of these orifice

pass and seal it up with wax; then fill the tube with distilled water, and place in it two or three layers of white linen moistened; seal it up by fixing the linen to the extremity of the tube. Plunge the tube by this last extremity into a vessel containing very pure water. By means of several moistened slips of spongy paper make the water of this vessel communicate with the negative pole of a column sufficiently energetic; and, finally, make the gold or platina wire communicate with the positive pole of the electrical column. The energy of this column being proportioned to the number of pairs of metallic plates, to their state, and to that of the humid conductors, would be, as is well known, proportioned to the capacity of the tube which contains the water under experiment. As soon as the circle is completed, it will establish an uninterrupted circulation, and by this means the water will gradually clear itself of oxygen, passing it off by the wire of gold or platina.

This astonishing change of water into oxygenated muriatic acid creates an agreeable surprise in the mind: *Felix qui potuit rerum cognoscere causas.* After having resolved this important problem, I proposed another to myself, which was as follows:

A volume of water, distilled and freed as much as possible from air, being given, it is proposed to extract the hydrogen from it.

Solution.

Take a glass tube with two orifices, the one straight and without any sharp edge, the other with a stopper, and of a diameter sufficient to introduce the distilled water without trouble. Introduce through the smallest orifice a wire of gold, platina, or other metal, and seal it hermetically with wax. Fill this tube with distilled water freed from air, close the other orifice with fine linen moistened with water folded three or four times; plunge the tube on the side of this second orifice into a vessel containing pure water; plunge into this water slips of spongy paper which communicate by the other extremity to the positive pole of the electrical pile. Finally, make the metallic wire communicate with the negative pole of this same pile. This being done, a rculation of the electrical fluid, as is w mmence, which gradually makes a quanti ar the metallic wire, which, being analys almost wholly pure hydrogen.

By this new method of decomposition ry much oxygenated, as is positively pr riment I have given in my *Opuscules*.

If that which several philosophical physicis true, that oxygen is an excellent remedy i ses, the philanthropist may have recourse lumn to obtain oxygenated water, and periments useful to society. In short, cle could we choose, by means of which t n into the human body, than a liquid so r

---

XXXII. *Proceedings of Learned S*

ROYAL SOCIETY OF LONDO

EB. 27. The Right Honourable Sir Jose nt, in the chair.—A paper by Mr. Home, ection of the prostate gland," was read. a drawing exhibiting minutely the situat s newly discovered gland, or rather pecul ngation of a part of the substance of t truding against the bladder. This diseas ly affects the bladder, has hitherto been irr m its true cause not being known; and s physiological discovery may be of in e towards relieving the sufferings of pa labouring under the effects of calculi a eases.

March 6. The President in the chair.— mmunication from Dr. Herschel, " or ocity of the solar motion," was comme

March 13. The President in the chair.- above paper, much of which was of d, being mathematical tables of the re the fixed stars. The observations contained in this paper are in continuation of a former communication from the author on the direct motion of the sun, and illustrate, with his usual ingenuity, the causes of the sidereal motions applied to stars of six different magnitudes.

March 20. The President in the chair.—A paper by J. Mendoza Rios, esq. was read, explaining the properties and use of an instrument for dividing circles.

SOCIETY OF ANTIQUARIES.

Feb. 27. The right honourable the earl of Leicester, president, in the chair.—The indefatigable Mr. Lysons furnished some very curious extracts from the Tower Records of Edward I., in which it appeared that Edward was extremely attached to different kinds of sports and pastimes, and particularly to a game with cards which he brought from Palestine after his croisade, where painted figures on paper had been in use long before the reputed discovery of cards by a Frenchman in the 14th century. This fact is worthy of attention, as it would lead to the discovery of the real origin of several other things which have been introduced by the same means into Europe, and which have latterly passed, but erroneously, for French discoveries. It will be remembered, that Edward, returning from the croisade, came through France, where he was treacherously detained as a hostage, and during which time he contributed very materially to disseminate the arts and civilize his then faithful subjects of Guyenne. It is also known that the Moors used something nearly similar to cards for amusement at Cordova and Granada, and it is most probable that they were of Carthaginian or Phœnician origin. Like almost all the utensils of civil life, games with cards have doubtless originated in commercial and mercantile countries.

J. P. Malcolm, esq. exhibited to the society the core of a horn that was found in St. Paul's Church-yard, nearly nine feet below the surface of the ground. This bone was supposed to have belonged to some of the animals sacrificed in the days of heathen superstition, as it is alleged that the site of St. Paul's was antiently a place where the Romans offered

up sacrifices to their gods. This
duced such a general emotion,
the hoary-headed antiquaries sho
the very learned author did not
which he exhibited had belong
On the durability of a most por
certainly never reflected, otherwi
posed it above 1500 years old!

Several historical documents,
were read, relative to the princi
Welsh prince of Wales (in 12
submit to the English dominatio

March 6. C. Orde, esq. vice
Some of the antiquarian friends
a learned lady, having expressed
grew on the oak, she ordered a se
tained the fact, which was com
society, and confirmed *viva voc*
who saw this parasitic plant att
pended in the hall of Berkeley c
tiquaries seem to have forgotte
or misletoe of the oak, has been

An interesting letter to the
S. Weston, B. D. was read, c
hitherto unknown brass coin of
Greece. On one side was a he
of grapes well executed. The
visible—ΗΥΨ; the coin having
The opinions advanced respecti
conjecture.

March 20. The right honour
A mining instrument, found i
Derbyshire, was exhibited. It
gouge used by carpenters, abo
diameter. The upper part of i
is evidently formed upon it, a
It is thought that this mine h
days of the Saxons; but no o
bable antiquity of the instrum

much more modern, and may have been used long since the mine in which it was found has been worked. Nor is the formation of spar one of the slowest processes of mineral aggregation.

GALVANIC SOCIETY, PARIS.

The following account of the proceedings of this society, during the years 1804 and 1805, was read at its sitting on the 6th of February 1806.

The pile of Volta has been considered in different points of view, and has experienced several new modifications in its construction. One of the correspondents of the society, M. Marechaux, has formed a pile of nine disks, composed of zinc and copper, separated by rounds of dry blotting paper. Cords of silk supply the place of the glass tubes in the ordinary apparatus, and hold it suspended to a hook. The pile thus constructed produces very sensible effects. M. Marechaux thought he remarked, by means of this apparatus, that the electrical tension of the pile increases and decreases in proportion to the electrical state of the air, and that its action is stronger the more the air is charged with humidity.

A new apparatus, to which the name of the Galvanic chain has been given, has been invented by M. Struve. This chain is composed of several double cones, one of copper and another of zinc, and so on alternately, soldered together by their bases. To the point of these cones is annexed a hook, which serves to join together a greater or less quantity of these double cones. Linen or cotton is placed between these latter, in such a manner, however, that the extremities are in contact with each of the extremities of zinc and copper. The chain, thus disposed and saturated with muriate of soda, is instantly in a condition to operate. It is, according to the author, less oxidable than the ordinary apparatus, and its activity is triple; a chain of 15 or 20 of these cones having as much energy as a pile of 30 or 60 disks.

It was very difficult, with the straw electrometer of Volta, and even with the electric balance of Coulomb, to appreciate

the feeble electrical tensions of t
having recourse to the condenser
in its effects, and of which the r
To remedy this inconvenience, di
been presented to the society, one
by count Sternberg; but none of
many advantages as one produced
proved by M. Veau-de-Launy.

Messrs. Nauche, Graperon, an
that the Galvanic action is aug
when the pile is exposed to a hi
when it is plunged into flame,
bonic acid gas, &c.; thirdly, the
fects of the pile are not transmiss
are then scarcely perceptible even

By analogous experiments M.
tained the non-transmission of G

Naturalists having announced
experiments on the conductibili
up the question anew. He has
terposed in the Galvanic chain p
fects of the pile. This he discov
This conductible property is ne
frogs being excited in a much m
flame is interposed.

The diamond, which several
pure carbon, is, according to the
telli, a non-conductor of Galva
tained, from the labours of M.
oxide of carbon is one of the ver

M. Herman, of Berlin, has
different substances employed a
has divided them into insulated

---

* Mr. W. H. Pepys ascertained, a co
of the pile is augmented by placing it in
in a vacuum; but, instead of *the effect* n
cuum, he has ascertained that the metals
metals, of course, are not oxidated—th
given out during the process.—Edit.

perfect conductors, and into uni-polar and bi-polar bodies, according as their conductible property manifests itself at both, or only at one of the extremities of the pile.

The theory of the decomposition of water by means of the apparatus of Volta has commanded the particular attention of the society.

One of the honorary members, M. Chompré, produced this decomposition in a very strong glass tube full of water and hermetically sealed, by means of a brass cap screwed on with leather between the joints. The result of his experiments was, that the Galvanic action takes place as well in the closed tube as in an open one, or one only partly filled with water; but that in the first, the water, in order to make room for the bubbles of the gas produced by decomposition, penetrates through the pores of the brass or greased leather which serve to close the tube, and makes its appearance in spite of every obstacle.

The reported formation of muriatic acid by the decomposition of water presented a new problem for the solution of the society; and numerous experiments have been made in order to ascertain the facts announced by M. Pacchiani. The results, however, have not yet been similar to his; but the society is still occupied in pursuing the same experiments.

M. Marum produced the decomposition of water by means of the grand electrical machine in the Teylerian museum: the two wires of platina employed in the experiment produced the liberation of a mixture of oxygen and hydrogen gases; and he was not able to obtain them separate, as he did with the pile.

Gautherot, whose loss every naturalist deplores, was the first who suggested the idea of accumulating the Galvanic fluid, and preserving it in apparatus where it was not spontaneously produced. He accomplished this by a method at once simple and ingenious.

" If we place," says he, " in a bottle of salt water, closed with a linen stopper, the extremities of two wires of platina, which traverse this same stopper without touching one another; and if we make the outward extremities of these two

wires communicate with the t
communication may be interrupt
excite a decided taste, and perha
will even produce the decomposit
ment demonstrates the presence
apparatus by no means proper to

"If we plunge the two extrem
tina in the extreme cups of the
bring these two ends near toge
and carry them to the mouth,
taste, the more decided in propo
wire is more considerable."

The discovery made by this au
which he has represented, ought
words, "the source or basis of
and concur, more than any oth
theory of this new branch of phy

Treading in the footsteps of G
ceeded a step further, in ascertain
a part of a Galvanic arc, pass, u
posite state from that which th
manner, that the side, which du
positive, becomes negative whe
versâ. This remark conducted
a secondary or charging pile,–
forms an epoch in the history of

This pile is formed of disks
copper, and of an equal numbe
water. It is raised on an ordi
laying on the disks of copper a
The whole is kept steady by me

The pile, constructed in thi
no perceptible phænomena; bu
communication with the Volta'
ties of that pile, displays an ele
motion, and gives sensations o
vanic phænomena in the same

The society resolved to asce
condary pile, with all the mod

tion presented; and although they obtained results a little weaker than those announced by Ritter, they do not hesitate to regard his labours, as well as those of Gautherot, as the most fortunate experiments which have been made since the invention of the pile of Volta; and they acknowledge that both of these philosophers deserve well of science—the one for having paved the way, and the other for having given a grand discovery to the world.

The effects of Galvanism in medicine have been also tried, but with little success hitherto. In some cases of asphixia it did harm; and out of an immense number of applications to deaf and dumb patients, both naturally and accidentally so, only two seemed to have derived any benefit.

Several poisons having evinced the Galvanic excitability, while others remained unmoved, M. Wranken took that opportunity of ascertaining different kinds of poisons.

UNIVERSITY OF GÖTTINGEN.

This university proposes the following question as the subject of a prize essay, to be given in before July 1807:—"What is the influence of the various taxations, on the morals and industry of the people?"

SOCIETY OF SCIENCES, COPENHAGEN.

Messrs. Chaptal and Cuvier have been elected members of this society.

Professor Treschow, of Copenhagen, has been occupied during the winter in a course of lectures on anthropology, wherein he has severely criticised the speculations of Dr. Gall on the nature of the human soul.

SOCIETY OF SCIENCES, GOERLITZ.

This society has proposed the following subject of investigation to the learned:

1. In cloudy weather it freezes but in a small degree until the thermometer of Reaumur has fallen to the zero point, or at least very little above it: Wherefore then, in a serene sky, does it freeze when the same thermometer is three or four degrees above the zero point?

2. Collect out of the w
relates to the knowledge i
and arrange these materia
a picture of civilization an

XXXIII. *Intelligenc*

VAC

The Prussian governme
ment for the progress of v
be struck of the value of
ing four ounces of silver ea
who contribute to its succ

KEPLER TE

A subscription has been
ment to the memory of
consist of a Doric temple
in the Sternbergian gardens

AST

Table of the right Ascen
Pallas, and J

	Ceres.					
	A.R.			Dec.N.		
1806.	h	m	s	°	′	h
April 3	6	55	4	30	52	5
6	6	58	28	30	47	5
9	7	2	8	30	40	5
12	7	5	52	30	34	6
15	7	9	48	30	26	6
18	7	13	52	30	18	6
21	7	18	0	30	10	6
24	7	22	16	30	1	6
27	7	26	40	29	51	6
30	7	31	12	29	41	6

Ceres and Pallas are too
seen in this country.

MECHANICS.

A mechanic of Copenhagen has made a model of a praam intended to conduct, without danger, ships of the largest dimensions across the ice. His model has been examined by the most celebrated engineers on the continent, and promises to be of great service to the Danish marine.

LECTURES.

Mr. Thelwall has opened a seminary for the cultivation of the science and practice of elocution, and the cure of impediments of speech; and has just commenced a course of lectures, at his house, No. 40, Bedford-place, Russel-square, on the physiological principles of his art, and the causes, prevention, and cure of the several species of impediments, natural and habitual. The intention of the lecturer is to treat his subject as a branch of natural and experimental philosophy; to investigate the laws of organic action upon which the phænomenon of speech depend; to consider at large the theory of the human voice, and of human enunciation; and to apply the principles of that theory to the practical improvement of the power and tone of the voice, and the facilities of enunciative expression. For this purpose, besides the more popular accompaniments of reading, recitations, and oratorical digressions, the lectures are illustrated by graphic and mechanical demonstrations of the essential propositions; and an attempt is made to place whatever relates to the fundamental requisites, and even to many of the higher graces of elocutionary expression, on the broad and sure foundations of anatomical and mathematical science. Even our perceptions of musical proportion, and the consequent laws of musical composition, are referred, for their origin, to certain principles of physical necessity, resulting from the structure of the organs of voice: and from the existing harmony between these principles and our perceptions of such proportions, Mr. T. builds his expectations of surmounting all impediments not resulting either from deafness or imbecility of mind. His plan, of course, includes the structure and application of artificial organs, &c., for the relief of those who have absolute deficiencies or mal-

conformations of the mouth.
receive into his house a limi
with impediments, and to gi
various branches of elocutior

LIST OF PATENTS F

A grant unto Patrick W
county palatine of Lancaste
improvements in the manu
posed of cotton, of flax, o
or mixtures of two or more
goods will resist the rotting
better than similar fabrics m
common use. Dated Marcl

To John Curr, of Sheffiel
in the county of York, gentl
different from any that has b
of spinning hemp for the
Dated as above.

To Richard Willcox, of t
in the county of Surrey, m
tain machinery for glazin
usually performed by hand.

To Edward Dampier, of
London, manufacturer; fo
perfection certain machine
ducing into small parts or p
other substances, for the us
easily to be pulverized by m
gard that he is connected ir
Thomas Shackleton, of Pr
March 12.

To Michael Logan, of I
Rotherhithe, in the count
invented and constructed er
and field artillery. Dated I

To Charles Robert West,
the city of London, opticiar
Head-court, Shoe-lane, in
optical turner; for their in

day or night telescopes, whereby the same will be rendered more portable than they now are. Dated March 18.

To Henry Gore Clough, of Norton-street, in the parish of St. Mary-le-bone, and county of Middlesex, surgeon; for his invented certain improvements in the instruments or apparatus commonly called trusses, which are used for compressing and supporting such parts of the human frame as are or may be ruptured or disposed to protrude. Dated March 21.

To Francis Place, of Charing-cross, in the parish of St. Martin in the Fields, in the county of Middlesex, tailor and mercer; for his invented certain improvements in locks for muskets, pistols, fowling-pieces, carriage guns, and every species of fire-arms. Dated as above.

To Richard Ottley, of Myrtle-hill, near Caermarthen, in Caermarthenshire, esq., and James Jeans, of Portsmouth, in the county of Hants, ship-builder; for their invented certain improvements in chain-pumps, in the mode of working the same, and in the wells for receiving such pumps, whereby much manual labour will be saved. Dated as above.

To Joseph Hinchsliffe, of Dumfries, in that part of the united kingdom called Scotland; for his invented new method of manufacturing elastic spring trusses for ruptures or rupture bandages. Dated March 26.

To Bracy Clark, of Giltspur-street, in the city of London, veterinary surgeon; for his invented certain improvements upon horse-shoes. Dated as above.

To Quintin M'Adam, of Anderston, near the city of Glasgow, in the county of Lanark, in that part of the united kingdom of Great Britain and Ireland called Scotland; for an improved method of dressing yarns for weaving, by means of a new and useful machine. Dated March 26.

To William Parr, of Bermondsey New Road, in the county of Surrey, gentleman, Richard Bevington, of Gracechurch-street, in the city of London, merchant, and Samuel Bevington, of Grange-road, Bermondsey, in the said county of Surrey, leather-dresser; for their invented machine for splitting hides, skins, pelts, or leather, in an improved manner. Dated as above.

METEORO-

METEOROLO

By Mr. Carey,

For Ma

Days of the Month.	Thermometer. 8 o'Clock, Morning.	Thermometer. 11 o'Clock, Night.	Thermometer. Noon.
Feb. 26	47°	50°	39°
27	43	50	36
28	34	43	34
March 1	35	42	35
2	45	50	46
3	46	54	46
4	37	44	34
5	34	40	32
6	32	37	32
7	35	47	42
8	40	44	40
9	42	43	32
10	32	37	32
11	32	36	28
12	26	30	26
13	25	36	33
14	37	48	32
15	32	42	33
16	36	36	34
17	36	37	35
18	36	40	39
19	39	46	40
20	40	47	41
21	40	52	46
22	42	54	44
23	46	57	49
24	49	54	47
25	47	52	47
26	45	49	46

N. B. The barometer's

XXXIV. *Account of a Series of Experiments, showing the Effects of Compression in modifying the Action of Heat.* *By* Sir James Hall, *Bart. F.R.S. Edin.*

[Continued from p. 155.]

III. *Experiments made in Tubes of Porcelain.—Tubes of Wedgewood's Ware.—Methods used to confine the Carbonic Acid, and to close the Pores of the Porcelain in a horizontal Apparatus.—Tubes made with a View to these Experiments.—The Vertical Apparatus adopted.—View of Results obtained both in Iron and Porcelain.—The Formation of Limestone and Marble.—Inquiry into the Cause of the partial Calcinations.—Tubes of Porcelain weighed previous to breaking.—Experiments with Porcelain Tubes proved to be limited.*

While I was carrying on the above-mentioned experiments, I was occasionally occupied with another set, in tubes of porcelain. So much, indeed, was I prepossessed in favour of this last mode, that I laid gun-barrels aside, and adhered to it during more than a year. The methods followed with this substance differ widely from those already described, though founded on the same general principles.

I procured from Mr. Wedgewood's manufactory at Etruria, in Staffordshire, a set of tubes for this purpose, formed of the same substance with the white mortars, in common use, made there. These tubes were fourteen inches long, with a bore of half an inch diameter, and thickness of 0·2; being closed at one end (figs. 9, 10, 11, 12, 13*).

I proposed to ram the carbonate of lime into the breech (fig. 9. A); then filling the tube to within a small distance of its muzzle with pounded flint (B), to fill that remainder (C) with common borax of the shops (borate of soda) previously reduced to glass, and then pounded; to apply heat to the muzzle alone, so as to convert that borax into solid glass; then, reversing the operation, to keep the muzzle

---

* Plate IV., given in our last Number.

cold, and apply the requisite he
the breech.

I thus expected to confine th
tempt was attended with consid
to the employment of various
shortly enumerate, as they oc
tice. The simple application o
sufficient, from two causes:
driven from the breech of th
among the pores of the pour
compressing force, by lodging
comparatively cold: 2dly, The
was always found to crack ver
could not be depended on.

To obviate both these incon
to me, in addition to the fir
borax (fig. 10. C) so near the
dergo heat along with the c
between this borax and the ca
in order to prevent contamina
in a liquid or viscid state, bei
pansion of the carbonic acid,
beyond it (D), and totally prev
escaping out of the tube, or
cold parts.

In some respects this plan a
glass of borax, which can
without innumerable cracks, u
mass in the lowest red heat;
periments begins only with re
at the same time with the
impervious as soon as its act
results were accordingly obtai
in practice, that as the heat
into too thin fusion, and w
of the silex, the space in w
empty on breaking the tube.

sary to oppose something more substantial and compact, to the thin and penetrating quality of pure borax.

In searching for some such substance, a curious property of bottle-glass occurred accidentally. Some of this glass, in powder, having been introduced into a muffle at the temperature of about 20° of Wedgewood; the powder, in the space of about a minute, entered into a state of viscid agglutination, like that of honey, and in about a minute more (the heat always continuing unchanged) consolidated into a firm and compact mass of Reaumur's porcelain *. It now appeared, that by placing this substance immediately behind the borax, the penetrating quality of this last might be effectually restrained; for Reaumur's porcelain has the double advantage of being refractory, and of not cracking by change of temperature. I found, however, that in the act of consolidation, the pounded bottle-glass shrunk, so as to leave an opening between its mass and the tube, through which the borax, and along with it the carbonic acid, was found to escape. But the object in view was obtained by means of a mixture of pounded bottle-glass and pounded flint, in equal parts. This compound still agglutinates, not indeed into a mass so hard as Reaumur's porcelain, but sufficiently so for the purpose; and this being done without any sensible contraction, an effectual barrier was opposed to the borax; (this arrangement is shown in fig. 11.;) and thus the method of closing the tubes was rendered so complete, as seldom to fail in practice †. A still further refinement upon this method was found to be of advantage. A second series of powders, like that already described, was introduced towards the muzzle, as shown in fig. 12. During the first period of the experiment, this last-mentioned series was exposed to heat, with all the outward half of the tube (*ab*);

---

* In the same temperature a mass of the glass of equal bulk would undergo the same change; but it would occupy an hour.

† A substance equally efficacious in restraining the penetrating quality of borax, was discovered by another accident. It consists of a mixture of borax and common sand, by which a substance is formed, which, in heat, assumes the state of a very tough paste, and becomes hard and compact on cooling.

by this means a solid mass was
cold and firm during the subsequ
carbonate.

I soon found that, notwithsta
tioned precautions, the carbonic
that it pervaded the substance
where no flaw could be traced.
defect might be remedied, were
trating state of fusion, applied to
that the pores of the porcelain m
of leather are closed by oil in
I rammed the carbonate into a
it with pounded glass of borax,
was applied, spread on the insid
fectually closed its pores. In th
periments were made with barrel
mon muffles (the arrangement
sented in fig. 13).

I was thus enabled to carry
porcelain, to the utmost that its
I was not satisfied with the fo
to obtain tubes of a superior qu
experiments with various porce
I so far succeeded as to produce
bonic acid was, in a great measu
ternal glaze. The best material
the pure porcelain clay of Corn
the proportion of two of this cla
call Cornish stone, which I beli
of decomposition. These tubes
long, with a bore tapering from
ness was about 0·3 at the breec
muzzle to the thinness of a waf

I now adopted a new mode o
vertically, and not horizontall
the thin state of borax whilst in
it ought to be treated as a co
supported in the course of the ex

secure perfect tightness, and obviate the failure which often happened in the horizontal position, from the falling of the borax to the lower side.

In this view (Plate VII. fig. 16.), I filled the breech in the manner described above, and introduced into the muzzle some borax (C) supported at the middle of the tube by a quantity of silex mixed with bottle-glass (B). I placed the tube so prepared, with its breech plunged into a crucible filled with sand (E), and its muzzle pointing upwards. It was now my object to apply heat to the the muzzle half, whilst the other remained cold. In that view, I constructed a furnace (fig. 14. and 15.), having a muffle placed vertically (*cd*), surrounded on all sides with fire (*ee*), and open both above (at *c*), and below (at *d*). The crucible just mentioned, with its tube, being then placed on a support directly below the vertical muffle (as represented in fig. 14. at F), it was raised so that the half of the tube next the muzzle was introduced into the fire. In consequence of this, the borax was seen from above to melt, and run down in the tube, the air contained in the powder escaping in the form of bubbles, till at last the borax stood with a clear and steady surface like that of water. Some of this salt, being thrown in from above, by means of a tube of glass, the liquid surface was raised nearly to the muzzle, and, after all had been allowed to become cold, the position of the tube was reversed; the muzzle being now plunged into the sand (as in fig. 17.), and the breech introduced into the muffle. In several experiments I found it answer well, to occupy great part of the space next the muzzle with a rod of sand and clay previously baked (fig. 19. KK), which was either introduced at first, along with the pounded borax, or, being made red hot, was plunged into it when in a liquid state. In many cases I assisted the compactness of the tube by means of an internal glaze of borax; the carbonate being placed in a small tube (as shown in fig. 18).

These devices answered the end proposed. Three-fourths of the tube next the muzzle was found completely filled with a mass, having a concave termination at both ends, (*f* and *g*, figs. 17, 18, 19,) showing that it had stood as a liquid

in the two opposite positions in
to it. So great a degree of tigh
in this way, that I found myse
source of failure. A number
explosion, but by the formatio
fissure at the breech, through w
acid escaped. I saw that this
the borax when in a liquid stat
ble metal in the experiments w
vice here formed indicated the
very powerfully, and to a very
this source of failure was rem
a very small air tube. This,
few experiments.

In the course of the years 1
a number of experiments, by t
scribed, amounting, together
rels, to one hundred and fifty-
and in which the apparatus
its power, constant success co
fact, many experiments failed,
sults, however, upon the wh
they seemed to establish some
inquiry.

These experiments prove, th
the carbonate of lime can be
without calcination, and to
carbonic acid, which, in an o
rature, would have been enti
these circumstances, heat pro
effects ascribed to it in the Hu

By this joint action of heat
lime, which had been introd
powder, is agglutinated into a
of hardness, compactness, an
proaching to these qualities in
of the results, by their saline

---

* See Appendix—(to be g

parency, and their susceptibility of polish, deserve the name of marble.

The same trials have been made with all calcareous substances; with chalk, common limestone, marble, spar, and the shells of fish. All have shown the same general property, with some varieties as to temperature. Thus I found, that, in the same circumstances, chalk was more susceptible of agglutination than spar; the latter requiring a heat two degrees higher than the former, to bring it to the same pitch of agglutination.

The chalk used in my first experiments always assumed the character of a yellow marble, owing probably to some slight contamination of iron. When a solid piece of chalk, whose bulk had been previously measured in the gage of Wedgewood's pyrometer, was submitted to heat under compression, its contraction was remarkable, proving the approach of the particles during their consolidation; on these occasions, it was found to shrink three times more than the pyrometer-pieces in the same temperature. It lost, too, almost entirely, its power of imbibing water, and acquired a great additional specific gravity. On several occasions I observed, that masses of chalk, which, before the experiment, had shown one uniform character of whiteness, assumed a stratified appearance, indicated by a series of parallel layers of a brown colour. This circumstance may hereafter throw light on the geological history of this extraordinary substance.

I have said, that, by mechanical constraint, almost the whole of the carbonic acid was retained. And, in truth, at this period some loss of weight had been experienced in all the experiments, both with iron and porcelain. But even this circumstance is valuable, by exhibiting the influence of the carbonic acid, as varied by its quantity.

When the loss exceeded 10 or 15 per cent.* of the weight of the carbonate, the result was always of a friable texture,

---

* I have found that, in open fire, the entire loss sustained by the carbonate varies in different kinds from 42 to 45·5 per cent.

and without any stony characte
cent., it was considered as goo
ties of a natural carbonate. In
the loss amounted, for instan
result was sometimes excellent
ing every appearance of soun
high character of crystallizatio
the action of the air; and, by
moisture, or both, crumbled
according to circumstances.
carbonate of lime, though not
acid, may possess the properti
a difference of this kind may ex
and give rise to their different

I have observed, in many ca
reached only to a certain depth
part remaining in a state of co
neral, of a very fine quality.
thus to take place in two diffe
proportion of carbonic acid is
carbonate; by the other, a por
calcined, while the rest is left
the effect of a feeble calcinin
time, and the other of a str
time.

Some of the results which
first produced, have been subj
calcination. It happened, in
specimen produced on the
fresh fracture has restored it.

A specimen, too, of marble
on 15th May 1801, was so co
man employed to polish it,
substance a little whiter, the q
would be of great value, if it
Yet, in a few weeks after its f

Numberless specimens, how
resist the air, and retain their

Some of them continue in a perfect state, though they have been kept, without any precaution, during four or five years. That set, in particular, remain perfectly entire, which were shown last year in this society, though some of them were made in 1799, some in 1801 and 1802, and though the first eleven were long soaked in water, in the trials made of their specific gravity.

A curious circumstance occurred in one of these experiments, which may hereafter lead to important consequences. Some rust of iron had accidentally found its way into the tube: ten grains of carbonate were used, and a heat of 28° was applied. The tube had no flaw; but there was a certainty that the carbonic acid had escaped through its pores. When broken, the place of the carbonate was found occupied, partly by a black slaggy matter, and partly by sphericles of various sizes, from that of a small pea downwards, of a white substance, which proved to be quicklime; the sphericles being interspersed through the slag, as spar and agates appear in whinstone. The slag had certainly been produced by a mixture of the iron with the substance of the tube; and the spherical form of the quicklime seems to show that the carbonate had been in fusion along with the slag, and that they had separated on the escape of the carbonic acid.

The subject was carried thus far in 1803, when I should probably have published my experiments, had I not been induced to prosecute the inquiry by certain indications, and accidental results, of a nature too irregular and uncertain to meet the public eye, but which convinced me that it was possible to establish, by experiment, the truth of all that was hypothetically assumed in the Huttonian theory.

The principal object was now to accomplish the entire fusion of the carbonate, and to obtain spar as the result of that fusion, in imitation of what we conceive to have taken place in nature.

It was likewise important to acquire the power of retaining all the carbonic acid of the carbonate, both on account of the fact itself, and on account of its consequences; the

result being visibly improved
complete saturation. I therefo
tigate the cause of the partial ca
taken place, to a greater or a le
ments. The question naturally
become of the carbonic acid se
cinations from the earthy basis
sel, and escaped entirely; or h
in a gaseous, but highly comp
me, that this question might be
the vessel before and after the
bonate.

With iron, a constant and ir
larity existed in the oxidation o
lain the thing was easy; and I
experiments with this material
question had occurred to me. T
as its muzzle was closed, and ag
exposed to the fire; taking car
to cool. In every case I found
that, even in the best experin
trated to a certain degree. I
the carbonic acid separated, re
gaseous form; and in that vie
had just been weighed, in a sh
surrounded, on the scale of
weight was ascertained, I brok
and then replaced upon the sca
fragments. In those experim
tion had taken place, the w
changed, for all the carbonic ac
the action of heat. But in th
that a loss of weight was the
tube.

These facts prove, that bo
operated in the porcelain tub
loss, part of the carbonic acid
sel, and that part had been

view methods by which the last could be counteracted; but I saw no remedy for the first. I began, therefore, to despair of ultimate sucoess with tubes of porcelain *.

Another circumstance confirmed me in this opinion. I found it impracticable to apply a heat above 27° to these tubes, when charged as above with carbonate, without destroying them, either by explosion, by the formation of a minute rent, or by the actual swelling of the tube. Some times this swelling took place to the amount of doubling the internal diameter, and yet the porcelain held tight, the carbonate sustaining but a very small loss. This ductility of the porcelain in a low heat is a curious fact, and shows what a range of temperature is embraced by the gradual transition of some substances from a solid to a liquid state; for the same porcelain which is thus susceptible of being stretched out, without breaking, in a heat of 27°, stands the heat of 152°, without injury, when exposed to no violence, the angles of its fracture remaining sharp and entire.

[To be continued.]

XXXV. *A new Fact in Galvanism. Communicated by a Correspondent.*

To Mr. Tilloch.

SIR,

WISHING to promote Galvanic inquiries (when unattended with cruelty), I shall beg the favour of you to insert in your Magazine the following circumstances, which I do not know have been observed before:

In trying to produce the nervous flashings by resting different parts of the face on a cylinder of wood covered with tin-foil, I was surprised by perceiving, when the nose was on this cylinder, that there was a strong disagreeable smell, like that which is produced in making inflammable air (hydrogen gas) in the common way, with sulphuric acid, water, and iron filings. This result I experienced several times; the cylinder resting on the copper end of a Galvanic trough consisting of 25 pairs of plates, 2¼ inch. When the nose was placed on a cylinder connected with the zinc end, no such smell was produced. *Quere*, How was the inflammable air (if any was) produced to make so strong a smell? The first time I perceived this smell was on Saturday last. I again tried the experiment this evening, and found the same result. I likewise tried it with two troughs, consisting in all of 50 pairs of plates; and then also perceived the smell: but the experiment was from the number of plates so very unpleasant (the shock being great) that I did not continue it very long, and did not determine whether the smell was proportionally strong.

---

* I am nevertheless of opinion, that, in some situations, experiments with compression may be carried on with great ease and advantage in such tubes. I allude to the situation of the geologists of France and Germany, who may easily procure, from their own manufactories, tubes of a quality far superior to any thing made for sale in this country.

With these 50 pairs of plates another effect occurred, which I had never seen before. I introduced in the circuit a small glass tube filled with milk instead of water, and whilst it remained in its place I did not see any alteration take place; but when I took out the wire, which was a silver one, and had been connected with the zinc end, I found a sort of crust adhering to it which looked like cream. *Quere*, Was not this curd formed by acid from the zinc end? A gold wire, which was connected with the copper end, I neglected to examine.

April 7, 1806. *A Friend to Physical Inquiries.*

XXXVI. *On Vaccination. An Examination of several of the Mis-statements of Dr.* ROWLEY. *By Mr.* J. J. HAWKINS, *of Islington.*

To Mr. Tilloch.

SIR,

HAVING for some years seen the most beneficial effects from the introduction of the cow-pock, as well from the practice of many of my friends, as with several I have myself vaccinated, I felt it a duty, on the first publication of Dr. Rowley's pamphlet, entitled "Cow-Pox Inoculation no

Security against Small-Pox Infection," to examine some of his alleged cases, in order that I might judge for myself, whether I ought to continue favourable, or become adverse to the new inoculation.

It was at first my intention to examine the whole of his cases; but, hearing that the indefatigable Dr. Thornton had undertaken the task, and knowing he was better qualified than myself, I relinquished it, after visiting ten of the 218 cases detailed in Dr. Rowley's publication. Of these ten, there were three grossly misrepresented; four could not be proved to have gone regularly through the cow-pock; of one no information could be had, the father of the child having died a twelvemonth before Dr. Rowley published the case; and two were most pointedly in favour of vaccination.

Dr. Rowley's scandalous pamphlet would have been totally unworthy of the least notice had he not addressed himself to the passions, and thereby wrought upon the credulity of the ignorant and unthinking; which renders it necessary that the cause of truth and humanity should be vindicated.

I understand there are several replies to Dr. Rowley, two only of which have come into my hands; one, a most excellent satirical piece, by "*Aculeus*;" the other by Dr. Thornton, two reports only of whose labours are as yet published: so far as he has already gone, he has entirely disproved and overturned Dr. Rowley's statements, and exposed the baseness of antivaccinarian proceedings.

From my own observations and practice, I can truly say, I have met with nothing but the most satisfactory evidence in favour of vaccine inoculation, and therefore I conceive it my duty to promote it by all the means in my power. Although the subject is so well handled by the two authors just mentioned, I think it will be of use to contribute my mite to the general stock of evidence, and shall be glad you will insert in your valuable Magazine the following statement of my examination of the ten cases:

Case 1. The case of Marianne Lewis, which is the 88th in Dr. Rowley's list, and the subject of one of his engravings, I examined with very particular attention.

The doctor states, that she was vaccinated "at the Small-

Pox Hospital *April* 1803,
out in the head, ears,
cow-pox blueish absces
they were better. In Ma
cow-pox abscesses, blueis
in every part of the body,
were nothing but cow-p
matter, cow-pox ulcers,
Lazarus, covered all ove
disgusting spectacle of te

On my visiting this c
told me that it was vacc
about 200 vaccinated at
her to be seen afterward
but only a little sore with
up. The child was partic
she had eruptions on the
four months. She was th
the eruptions came agai
they are now, for the mos
Dr. Rowley gave it as his
cow-pock nor small-pox,

From both these stater
vaccinated for the cow-po
tion; but the doctor has
have made it no evidence
child *did not take the co*
and that, for eleven mon
particularly healthy.

There is some differen
the doctor states it to c
better in *cold weather*; b
in April, and continued
test month in the year,)
the May following.

From my own exam
the eruption was very
but it was sufficient fo
any way twist facts to

for which end he has most grossly misrepresented this case.

Case 2. Mr. Joules's son, Dr. Rowley's 30th case, stated as follows:—" Vaccinated at the Small-Pox Hospital; terrible tumour in the face, of which a drawing is given resembling an ox."

I saw this child, with his parents, in November 1805. The father told me that the boy was vaccinated four or five years since: soon afterwards he had a slight breaking out on the face, which continued about a month: from that time he was perfectly well for three or four years, when a swelling came in his cheek, but was attended with so little pain, that it did not hinder his playing in the streets as much as other boys. Mr. Joules said, Dr. Rowley promised to undertake the cure gratis, but never troubled himself about it after he had the boy's picture. *The father and mother both declared they did not think the swelling was caused by the cow-pock.* It appeared to me a scrophulous case, and nothing could be further fetched than the notion of its resembling an ox.

Case 3. Mr. Wild's child, the doctor's 135th case, who, he says, took the small-pox, in the natural way, in August 1805, although vaccinated *two years before.*

I saw the mother and child in October 1805. She said the child was vaccinated *three or four years before* it took the small-pox; but the place of inoculation was very small, and did not appear like the cow-pock she had seen in other persons; from whence it is evident, although the child was inoculated for the cow-pock, it did not receive it. Is it any wonder then, that the small-pox infection took place when the child was exposed to it? Certainly not. And it is therefore a gross misrepresentation of the case, to call it an instance of cow-pock failure.

Case 4. Mr. Colson's grandson, Dr. Rowley's 137th case. This he states took the small-pox two years after cow-pox.

In October 1805, I saw Mr. Colson, the grandfather, and also the child's mother, who was but seventeen years of age when her child was vaccinated; and thoughtlessly neglected

to carry it to the Skinner-
lated, to be examined so c
institution. This, she tol
the station. It therefore
went regularly through th

Cases 5 and 6. Mrs. L
77th case. He states the
after vaccination: but fro
tain from the mother and
passed regularly through
they ought not to have
against vaccination.

Case 7. Mr. Nicholso
" Small-pox two years af
of the vaccination is not p
dence of the child's having
saying there was one sn
which he *could* have taken

Case 8. Mr. Rice's ch
could obtain no other inf
been dead above a year, an
not learn where.

Cases 9 and 10. Elizab
ley's 37th and 38th cases;
" Vaccinated May 10th, 1

I saw these two children
ber 1805. Her relation
children, one of whom to
way, and had them very
of the other two having
advice of some friends, s
thereby to lessen the virule
justified the procedure: th
through the small-pox so
scarcely impaired, and it
of the two diseases predomi
the one that was not va
distressing confluent smal
lible marks all over the fa

scar on the neck, just above the right clavicula; together with a general debility, which six months of time had hardly lessened.

Thus is seen, that these two cases, which Dr. Rowley has, by misrepresentation, endeavoured to warp to his own purposes, are most pointedly and strongly favourable to vaccination: how far it is so with the rest on his black list, will no doubt appear soon, from the labours of Dr. Thornton. I have much reason to believe they will, for the most part, be proved to be misrepresentations of facts, in themselves neither for nor against vaccination: some few mistakes may have arisen from the inexperience of the early vaccinators,—this was to be expected by every rational person: many of the cases will be found highly favourable to vaccination; but a considerable number of them contain their own refutation, which any one who reads with attention may discover. I am, sir,

Your humble servant,
JOHN J. HAWKINS.

Islington,
March 24, 1806.

XXXVII. *On the Method of extracting Spirits from Potatoes. By M.* GERMAIN, *Chemist to the Military Hospital at Hanau*[*].

IT has been the practice, for a long time past, in Germany to distil spirits from potatoes. In the eastern part of Prussia, and in Lithuania, they employ an immense quantity of these vegetables in distillation. In these countries they are generally planted as the first crop in grounds which had been formerly untilled; and with proper care, and in good seasons, they produce abundantly. The residue, after distillation, is an excellent drink for cattle, particularly cows, whose milk is greatly increased by the use of it. When potatoe spirit is properly distilled, if not mixed with any foreign matter, and if the potatoes have not been heated too much, or burnt, during their preparation, it has a taste and

---

[*] From *Annales de Chimie*, tome lvi. p. 207

flavour far superior to the
oats, which is preferred onl

It has been said that pot
spoiled upon crossing the li
tunity of proving the contra
sent to these two objections
that it has been preserved i
months, and that, accordin
regulated for the experime
without having lost any o
soured. From the result o
reason to believe that this sp
subject to the two inconv
proached, than that produ
thing which has been said
judice.

Method of performing the
S

A sufficient quantity of
toes; for instance, 100 bush
and a half of malt; and thi
heads of spirits, which, acc
ter, marks from the 36th t

I know also, by experie
potatoes, and 10 of malt,
spirit, and of the same str
haps, that to produce the
tatoes, it requires a larger
than common grain does,
number of casks, and a g
this is a mistake; because
determinate quantity of gra
of potatoes and malt. T

• Richter's areometer is the sar
that each degree of the former i
expressly made for the purpose.
such a manner that the number a
tity of alcohol. Thus, 36, indica
liquid.

quantity of spirits, provided care is taken not to dilute the potatoes so much as grain, because they have not the same property of swelling which grain has; and provided also, that a good fermentation has been produced, and the spirits have not been burned in the still. As for the fewel required to prepare the potatoes, the additional expense is trifling, although, in every case, boiling water is made use of. Water in this state is used to prepare the potatoes, as the operation is performed by means of the steam of the water, which it is necessary to keep boiling half an hour or three quarters longer, according to the quantity of potatoes employed; and this is the only additional expense which may be reckoned upon.

The preparation of the potatoes must be carried on in vessels made of oak, the staves of which ought to be very thick and solid, and the bottom bound round with iron, in order to guard against accidents in removing. The top of the vessel must have a square aperture, with a thick covering, which should fit exactly; this aperture serves to let the potatoes into the vessel after being well washed: there ought to be another smaller aperture in the side, with a covering to shut close, for the purpose of drawing the potatoes out of the vessel.

It is then placed upon a tressel by the side of a still, different from that which is used for general purposes. On the same side, *i. e.* opposite to the still, and a little above the lower part of the tun, there is an aperture into which the beak of the still is inverted, by means of which the steam is conveyed to the potatoes. In the centre of the bottom of the tun there should be another small aperture, through which to evacuate any thick fluids which may collect in the tun; and in order that the weight of the potatoes may not choke it, the cover should be made to open inwards. When the potatoes are prepared, which the workmen will easily discover by means of the apertures in the tun already described, the beak of the alembic is withdrawn: the potatoes are immediately afterwards ground by a machine, or a kind of handmill, placed before the tun close to the small side-aperture. This mill is composed of two cylinders of very

hard wood, or stone, which
gether, as occasion requires,
handle to it, which serves to
together.

Above the cylinders there
which the potatoes are put at
by little and little, by means
by the action of the cylinders
diately into a tub placed be
tub indispensable, is, that h
iron scraper, to detach the
here to the cylinders.

When the potatoes are th
is put into a tub and diluted
care not to dilute it too mu
with it by tubfuls as they a
finished the necessary quan
ingredients are stirred until p
least lump left. The liquor
however, at intervals until t
state to receive the yeast.

In some places beer yeast
ficial ferment is prepared.
nce. This last yeast is
rice in cold water: boiling
broth is formed. All the
from the care taken in hea
heated, the whole mass wi

To conclude:—It may b
much more easily than grai
mentation besides is very st
tity of froth: but it does
whole of it, because, in
membranous part of the po
through which the froth ca
rience shows that, upon
rots and beet-root, the spi
abundant than when ma
alone; and the advantage

from this last method of proceeding have not been confirmed: on the contrary, it is completely proved, that the addition of carrots gives the spirits an exquisite taste and flavour.

Chemists pretend that it is the saccharine substance which causes the vinous fermentation; that the more of this substance any body contains, the better adapted it is for fermentation. The present experiments on potatoes seem to prove that this assertion is not strictly correct; for they contain no saccharine substance, but merely starch, and yet they ferment. We see in corn, that the quantity of spirits is in proportion to that of the starch, or perhaps the glutinous substance which it contains: wheat, for instance, which contains both the one and the other, in greatest abundance, yields also the greatest quantity of spirits.

The opinion of those who assert that corn in germinating acquires thereby a mildness, seems to me of no weight, because hitherto little light has been thrown on the subject; which has not been yet exhausted by rigorous experiments comparing the different kinds of grain, germinated and not germinated. There are some very intelligent distillers, who still doubt if a determinate quantity of grain produces a greater quantity of spirits because that grain has germinated.

XXXVIII. *Means of destroying the Insects and Caterpillars which attack Fruit Trees. By* MADAN GAÇON DUFOUR[*].

We know, by sad experience, that the husbandman has every year some accidents which unexpectedly diminish or destroy the produce of his ground, without having to reproach himself with any want of care or attention.

The present year, for instance (1805), offers a singularity which I have not before perceived. In some districts the cherry-tree has experienced, at the time of its blossoming,

---

[*] From *Bibliothèque Physique Economique*, No. 12, August 1805.

colds and winds which hav
another plague, not less di
trees and plum-trees ov
Great swarms of little anim
which are not so in realit
the extremity of the branch
as a branch was attacked,
was dried up. On opening
of ants was discovered, wh
began the ravages, sucked
What I have remarked is,
ters attack any tree, the n
riences the same fate; bu
partial. In an alley of c
have seven been attacked,
each other. One tree wa
very much damaged by th
not hurt.

On these vermin the s
all: this convinces me tha
nary kind.

Plum-trees, when attac
their fruit like the cherry-
them with more rapidity,
ance of fruit.

Having effectually wate
with ashes, in the manne
the vermin were destroye
a tree of low height.

I made one remark, w
nicate: it is, that plum-
necessarily watered, are
those which have experie
the plants in their neighb
solutely necessary. I h
chokes: we know very
of water; and the tree w
leaves withered, and the

trees, in ground not watered at all, were much less attacked. This convinces me that these were not the ordinary vermin abundant in dry seasons.

I was only able to protect my cherries a little, by cutting off the extremities of the damaged branches.

Several people had recourse to sulphur; but I did not follow that method. The smoke of sulphur destroys the insect, I admit, but it is at least equally dangerous to the tree; I always prefer an aspersion of the tree with soap-suds. This very year I experienced the good effects of it. I saw my plum-trees look green again, and the insects abandon them. The aspersion is very easily managed, by means of watering-pots or small garden-engines. I have also employed a ley of wood-ashes with the same success as soap and water.

An observation equally important which I have made is, the great damage done this season in all orchards by the caterpillar. As soon as they devoured the young leaves they attacked the fruit. In spite of the great care taken in spring to get rid of them, the number of these insects is incredible. I have seen them unite on the large branches, fix their nests to them, and protect them by means of the downy matter which covers the buds of the ensuing season. Whatever precaution is taken, it is almost impossible not to destroy these buds. It is only necessary to take off these nests and burn them; and this is the only way of getting rid of the coveys. I employed the same aspersion for my apple-trees, and by that means got rid of their enemies also.

XXXIX. *Experiments upon the Gaseous Oxide of Azote, made at a Meeting of Amateurs, of Toulouse. Described by M.* DISPAN, *Professor of Chemistry in the Institution of that City*[*].

FOR several years past, plenty of experiments have been published on the effects of the gaseous oxide of azote inhaled into the lungs. But these experiments, almost always

---

[*] From *Annales de Chimie*, tome lvi.

different, and often contradi
no basis positive enough on
the subject. Such, at least, w
several distinguished chemica
of the singular properties attr
actual experiments made on
for the purity of the substa
precautions used on the oc
minutes on the spot of the e
sons at least, several of whon
I presume that this publica
terest.

First

The nitrate of ammonia
stallized, but nevertheless v
gent, and it had a slight sm
by the distillation of sal-an
and the simultaneous satura
ammoniacal gas liberated b

We then put about a h
of this salt in a small retort
The salt melted and boile
gas: at last the retort was
soon disappeared, and the g
rated very rapidly; when
In a short time the produc
we stopped the operation,
retort; which convinced us

Emboldened by this resul
hectogrammes (about six o
yielded enough of gas to fill
we lost a great part of it. Th
successfully as at first, unt
retort; but a circumstance
and for which we could no
of an abundant red vapour
portion as it cooled, alth
nitrous gas: this we ascei

Effects of the Gaseous Oxide of Azote when introduced into the Lungs by Respiration.

All those who have tasted or inhaled this gas agree that it has a taste strongly saccharine, the impression of which has been often retained during the whole day. I myself experienced also a nitric taste (in truth, it was the gas latterly produced which I tasted). M. de M—— said, no doubt upon perceiving the same taste, that there was something styptic in it. The rest did not perceive any thing else than a saccharine taste; which is certainly a very decisive one, considering the small quantity of matter which the gas could contain.

The following is a precise account of the different effects of the gas, as they were successively experienced by the various gentlemen who inhaled it. The gas was inhaled by means of a bladder with a stop-tock, the nostrils being held close, and the lungs emptied as much as possible.

M. G—— suddenly lost all recollection at the third inhalation: he continued it for five minutes; after which he returned to his senses very much fatigued, without being able to recollect any other sensation than a sudden fainting, and a tingling in the temples.

M. de M—— experienced a saccharine and styptic taste, a great dilatation, accompanied with a heat in the breast; his veins were swelled, and his pulse fell. Every object appeared to dance round before his eyes. He thought, however, that he could have supported a stronger dose. The bladder was not large enough for his lungs.

M. de P—— experienced a saccharine taste at the first inhalation, which became afterwards imperceptible. His lungs were strongly dilated, and with great heat. He experienced very agreeable sensations after laying aside the bladder, and he fell into involuntary fits of laughter.

M. de S—— experienced the same saccharine taste as the former gentlemen, and the impression of it continued from ten o'clock in the morning until past midnight; he also experienced vertigoes, and his legs remained benumbed all day.

M. G——, the same sacch
the bladder he experienced
wards a very pleasant sensati
whole body. His legs were

M. de C——, a saccharin
tingling in his ears, legs b
choked up. Upon the wl
experienced as more painful

Exp

I was anxious to know in
straint of breathing in a blad
These gentlemen, at my requ
of breathing common air in
found themselves mechanic
agreed in the same results.

Another

I was also anxious to try
who inhaled it assured me t
ence between it and commo
an augmentation of heat in

Co

Thus the singular effect
gaseous oxide of azote alon

Secon

The object of our secon
large the experiments rel
gaseous oxide of azote.

We put into a retort al
16 ounces) of the nitrate o
lengthening tube was ada
whence, by means of a t
into the tub. The retort r

Upon the first applicatio
almost at the same time so
in the retort, but in very

vessels which the heat disengaged yielded also a nitrous smell to such a degree, that we were afraid of the success of the operation; these vapours and smells, however, insensibly diminished, and at last totally disappeared. About this stage of the operation, the bubbles which were disengaged had a manifest smell of the prussic acid, which continued a long time. At length the retort was filled with white vapours, and the gaseous oxide of azote began to pass, which it soon did so abundantly that we removed the fire; and having again replaced the charcoal, the gas, which had ceased during the interval, reappeared in such abundance, that the luting gave way at one place. In spite of the loss of a considerable quantity in consequence of this accident, the disengagement of the gas into the tub continued very rapidly during a quarter of an hour.

This circumstance gave us reason to believe, that if the luting had not given way, there certainly would have been an explosion.

Twelve persons submitted themselves to the experiment of inhaling the gas at this meeting, several of whom repeated it twice. It is right to observe, that the most of them had inhaled the gas at the last meeting, when two out of seven experienced a sensation of pleasure; but on this occasion none at all, and not even these two, experienced such a sensation. On the contrary, several suffered very severely.

M. de M—— stamped with his feet all the time he held the bladder. After recovering from a profound stupor, he informed us, that he felt as if he had got a blow with a dagger on the back part of his head capable of killing an ox, and which he would not experience again for any thing in the world. The rest, in general, experienced vertigoes and dazzling of their eyes, which were succeeded in some of them by fits of laughter. I myself was of the latter number, and the following is an exact account of what I felt:

At the first inspiration I emptied the bladder. A saccharine taste immediately filled my mouth and my lungs entirely, which dilated considerably. I emptied my lungs and filled them again; but at the third trial my ears tingled, and I let

I let go the bladder. I contin my recollection, rolling my e burst into such a fit of laughte in my life. After some sec ceased, as did also the other s

M. de P—— experienced n motion in some muscles of t diarrhœa in the course of t rienced the same effects.

Upon the whole, it would b effects of gaseous oxide of azo ner, since these effects vary what is very singular, even i S——, who inhaled it four ti time. For my own part, I laughter in one of the severa certainly have fainted had I p

Effects of the Gaseous Ox

I have only one experimen pears worth reporting.

I put a greenfinch into a g of azote. The bird appeared it soon closed its eyes, laid it peared as if asleep. When l set at liberty, it placed itself to fly away. It was submit cond experiment, and allowe no efforts could restore it to

It appears very remarkable to get away, and that it fel takes place in the other gase

XL. *Report of Cases in the Finsbury Dispensary, from the 1st of January to the 31st of March 1806. By* JOHN TAUNTON, *Esq. Surgeon to the City and Finsbury Dispensaries, and Lecturer on Anatomy, Physiology, and Surgery.*

SINCE last report (Phil. Mag. vol. xxiii. p. 312.) there have been admitted into this dispensary 160 patients.

Cured	66
Relieved	5
Irregular	3
Under cure	86
	160

Of these, 33 have been visited at home, and eight have submitted to operations.

In the last surgical report (see January) there were 80 patients under cure, 70 of whom have been cured and 10 relieved, 18 have been home patients, and two have undergone operations.

Mrs. Cuffee, æt. 50, has been subject to rheumatism and asthma for several years. She observed a tumour in her left breast some years ago, irregular on its surface and occasionally attended with darting pain, which was not severe, so as to excite much attention, till March 1805, when the breast had increased much in size, and was become very painful. The unfavourable symptoms continuing, she was admitted into the dispensary in November last; but, owing to her bad state of health, nothing could be done at that time to remove the disease in her breast. In January, her health being improved, it was determined, in consultation, to propose the operation, that being the only mode of treatment likely to give her any chance for recovery. To this she readily consented, and requested that an early day might be named for its performance.

The operation was performed on the 28th of January, which she underwent with the greatest fortitude, and had very little symptomatic fever considering its magnitude: as she had naturally a very full breast, the size of which was much increased by the disease, the wound filled with granulations,

lations, and was complete
than could have been expec
was 14 inches in length, an
ments were necessarily rem

Mrs. F., æt. 31, has had
joyed good health previous
the end of May she observe
the neck, but, as it was no
not excite much attention;
to be very hard and immov
it impeded respiration and

She was admitted into th
tember, when the tumour
deglutition and respiration,
had much alarmed the pati
ostosis of the clavicle, near
It reached to the upper par
it grew from the clavicle
length, and it must have b
cumference. In this case
mode of treatment short o
been attended with great
the inner as well as from t
and was nearly in contact

Cicuta fomentations we
the pain; in which they h
arrest the growth of the t
quassia, and the fomentat
of October, when it was
increased, and the pain w
period. The emp. hydra
with a view to increase t
magnesia vitriolata was t
renewed once in about ev
gradually decreased in siz
end of December, and sh
of January 1806.

Greville-street, Hatton-garden,
April 5, 1806.

XLI. *On the Oxidation of Metals in general, and particularly the Oxidation of Iron. Read in the French National Institute by M.* THENARD[*].

As soon as oxygen was discovered, researches became general to ascertain its properties, and it was very soon discovered that this gas was the universal agent of combustion. Phlogiston was immediately exploded, and hypotheses totally contrary to experience were no longer resorted to in order to explain the generality of phænomena. By admitting the presence of this principle, more or less, in the metallic calces, an exact account may be taken of the augmentation of weight which metals receive when calcined. But, however simple this theory may appear at present, it was nevertheless the result of a grand effort of genius.

When it was clearly demonstrated that metals, as well as other bodies, so far from losing their principles by combustion, absorbed a new one, because they are thereby augmented in weight; when Lavoisier taught us, that in this phænomenon, the cause of which was for such a long time unknown, the atmosphere was decomposed, and that one of its constituents formed a new combination, the properties of burnt bodies were examined with more care; a great number of new principles were discovered in such bodies, and in many of them the quantities of oxygen and of the radicals which formed them were determined. These new observations were again the source of many discoveries. It was seen that the same combustible body might be combined with oxygen in different quantities, and that consequently several oxides, as well as several acids, might have the same radical. Frequent applications of this principle are met with, particularly in the oxidation of metals; and at this period, lead, antimony, and manganese, offer the most remarkable of these applications. It was this variety of oxides which led the author of the Chemical Statics to think that there actually was not so much difference as had been previously believed between oxides of the same genus; and

---

[*] From *Annales de Chimie*, tome lvi.

this led him to belie
were the result of
metals pass from the
genation by going
oxidation in such a
multitude of different

I am well persuade
much greater than
not pass immediately
some of them, from
high one; that betw
intermediate degrees
oxides: but I confes
are as many oxides a
if the theory admits
in fact, why should
acids? The cause can
that metals, at a cert
finity for acids than
it may happen, that,
of oxygen, they may
or less quantity the
existence. The latte
the former; there wo
the former would be
stop; and besides, th
which have the same
the *sulphurous* acid a
phorous and *phospho*
acids? And if these
phur, phosphorus, &
acids, why do metals
ides? why should not
well for the one as the
that hydrogen forms
fixing more than five
There are many reaso
tals are absolutely li
though it is proved th

neral principle of combustion, a multitude of different combinations, I am persuaded that metals, which we regard with reason as analogous bodies, are not more susceptible than the others of a multitude of different degrees of oxidation.

If we are permitted to entertain doubts on this view of the subject, we may certainly have some upon the nature of the oxides in their combinations with acids; and even if this truth had not been long admitted by chemists, some general observations would suffice to place the subject in a clear point of view. Let us take a glance, however, of each of these oxides, and attentively consider the oxides of iron, which are the principal objects of this memoir. Here every thing demonstrates, that in combinations of this sort the oxides are constant. Although cobalt, nickel, lead, zinc, gold, and platina, are all the bases of several oxides, yet in all the salts which they form they are always equally oxidated: thus the oxide is blue in all the salts of cobalt, green in those of nickel; it is white in those of bismuth, zinc, and lead; and it is gray in those of silver, yellow in those of gold, and brown in those of platina: it varies, to be sure, in the salts of antimony, tin, mercury, copper, and iron; but still with several of them it is only certain of their oxides that can unite with acids. Two white oxides of antimony alone are susceptible of this combination—the white volatile oxide and the white oxide of the second degree; the white oxide at the maximum is not attackable, except by the muriatic acid: still, however, if it is not in a state of very minute division, the muriatic acid dissolves it with great difficulty, and always by partly passing to the state of oxygenated muriatic acid. Tin, mercury, and copper, like antimony, do not form saline combinations with the acids, but under two states of oxidation; tin in the state of a gray and a white oxide, mercury in the state of a black and a red oxide, and copper in the state of a yellowish white and a brown oxide.

Hitherto it was thought that it was the same case with iron, and that in all the salts which it was susceptible of forming, the oxide was always green or red. Some chemists, however, have admitted an intermediate oxide: they believed

that there was also a yellow o
present themselves sometime
upon the hypothesis that all
of the same shade as their o
to adopt that idea; but it is
method of viewing the subj
a salt is often white or red al
Another salt, consequently,
red oxide for its base: this is
yellow salts of iron. Besides
ever, there exists another o
very important part in the fe
and as, on the one hand, th
tions manufactured in the wo
as the explanation of several p
themselves in the arts, depen
ide, I think it my duty to ent

It is formed when iron is
and we obtain it by decomp
and ammonia, the various
means of a solution of iron
demonstrate its existence.
some alkali, a white preci
speedily green at the surfa
lour *. These changes of
whole mass if it is agitated
absorption of oxygen; be
ment in a flask, the air whi
in volume, and soon exti
when the white oxide has
reason when it has passed

It is this white oxide, h
which forms, in a great m

---

* I poured some hyperoxidate
caustic potash, and I always obser
mixture in a retort the neck of wh
came green, and was even red at
perceptibly white, although it c
vinced myself by washing it, dissol
nitrate of barytes to it.

in commerce. Nevertheless, besides this combination, the white oxide may still form a sulphate much more acid; and then, instead of being of a dark green, the compound approaches to a clear emerald green. Thus we find there is a green oxide as well as a red oxide of iron; each of them, on being united with sulphuric acid, gives birth to at least two very distinct salts. Let us now proceed to examine these six kinds of sulphate of iron.

I shall distinguish the first of them by the names of acidulated sulphate and acid sulphate of white iron, because the oxide in these is colourless, and the one much more acid than the other; the second, for the same reason, under the names of acidulated sulphate and acid sulphate of green iron; and the third, for the same reason, I shall term neutral and acid sulphates of red iron.

The acidulated sulphate of white iron is obtained by boiling sulphuric acid diluted with water upon an excess of iron filings or turnings. When dissolved, or in particular crystallized, it is always of a bottle green, and the more coloured it is, the more is it esteemed in commerce. It instantly loses this colour upon an addition of sulphuric acid; it then takes an emerald green and becomes acid sulphate of white iron, which alters blue colours much more than the former*: it is then less fit for the operations of the arts, and rejected by manufacturers, who give a preference to the former, not from prejudice, but founded on the nature of saline

---

* When sulphuric acid is poured into a solution of acidulated sulphate of white iron, evaporated in such a manner as to mark 36° to the weight of the liquor, it almost immediately forms an abundant white and crystalline precipitate, which is nothing else but acid sulphate of white iron. This is the reason why, in vitriol manufactories, it sometimes happens that the liquor becomes all at once troubled to a certain degree, and leaves a deposit of a white matter, which is rejected by the manufacturer, and gets the name of magnesia. The solution is then too acid, and the escape of this excess of acid takes place instantly, so as to form an acid sulphate which is precipitated, and an acidulated sulphate which remains in solution and crystallizes much more regularly than the first. This inconvenience might be guarded against by boiling the solution a longer time with iron, and adding water to it, if necessary; because the acidulated sulphate of white iron or the sulphate of iron of commerce, when it is too much evaporated, is also susceptible of partly concreting itself; at least it sometimes does so suddenly, all in a mass.

compositions; it may be trans
sulphate by heating it with iron
veral vitriol manufactories, a
where this salt is extracted fr
burned, and which without tha
less beneficial in commerce. T
kind of acid sulphate, whatev
tural or artificial, the transfor
would still be made whether t
red. The acidulated and aci
both precipitated white by th
compose oxygenated muriatic
as more or less of it is introdu
sulphate in which the oxide
manner that the oxygenated m
white oxide; such also is the a
binations of this oxide with ac
phuric acid. This is the reaso
lutions is not constant; from
the liquor is troubled, depos
ceases to be coloured. All t
plained from natural causes,
the properties which the other
us, of which we are now abou

The acidulated and acid su
which result from the comb
iron with sulphuric acid, pr
ences. The first (being tha
does not crystallize at all, no
a liquid state; if submitted t
from the air, becomes troub
phate, yellow, insoluble, an
transforms itself into acid s
always green, but itself almo
every kind of decomposition
although it has green oxide f
is what occasions the error of
the present moment, have r
much oxygenated: thence it

lated sulphate of white iron, the solution of which is of a fine green, reddens on its exposure to the air.

Oxygenated muriatic acid converts it all at once into acid sulphate highly oxidated; iron, on the contrary, converts it into acidulated green or little oxidated sulphate; the sulphuric acid makes it lose its red colour immediately, by transforming it into an acid sulphate almost colourless, or at least only slightly green. This acid sulphate may be crystallized by a well managed evaporation; the crystals formed are something of an emerald green colour, and in this respect it approaches an acid sulphate little oxidated; they do not sparkle nor deliquesce; their solution in water, which is but little coloured, does not, like the acid sulphate of white iron, absorb oxygen till after a long time: the excess of acid which they contain fixes to a certain degree the oxide of iron; nevertheless by means of oxygenated muriatic acid the oxide becomes red; and by means of iron it passes to the state of white oxide, particularly at the temperature of boiling water. Both the acidulated and acid sulphates of green iron precipitate themselves green by means of the alkalis. The precipitate contains no acid when a great excess of base is added, and particularly when heated: in every instance it is green. It is by treating the red oxide of iron with diluted sulphuric acid that we obtain the acid sulphate of red iron; the solution would not take place if the acid were concentrated. The acid sulphate of red iron contains more acid in excess than the acid sulphate of green iron, and the latter much more than the acid sulphate little oxidated. These properties are common to them with all oxides of the same kind; they require the less of any acid for their saturation the less oxygen they contain; and, on the contrary, they require the more acid the more they are oxygenated; this is proved by antimony, mercury, tin, copper, and iron. They alone among all the metals combine with acids at different degrees of oxygenation; and all, without exception, are subject to this law. This is the reason why the solution of muriate of tin little oxidated becomes troubled by the contact of the air, or when being crystallized we attempt to dissolve it. It is also for this reason that this

same recent solution
sublimate and revives t
gen from it, but even t
pens that the acid sulp
in part, by absorbing ox
acidulated sulphate, an
happens at last, that th
lated, becomes trouble
water into its solutio
upon the same cause;
branch, I should wan
I propose to treat.

Like the two other
of iron is almost col
and reddens when its e
potash; by adding a g
neutral sulphate is pre
susceptible of being de
as well as all the hig
from hydrogen, and re
or white sulphate of ir
ration: the iron chang

I have but little to s
phate: it is yellow and
in time, by exposure
tions of green or whit
sulphate which is depo
dulated sulphate of iro
red becomes almost co
state of acid sulphate;
formerly took for a par
to admit a yellow oxid
red and the green.

The action of the m
sembles much that of
atic acid does not diffe
are not so well charact
riate when little oxidat
stals formed from it ar

tion is exposed to the air, the iron becomes more oxidated, and as it then requires a greater quantity of muriatic acid to dissolve it, it is partly precipitated. No nitrate, however, exists in which the oxide is white. We can only obtain green and red nitrates of iron; the first is formed by taking five parts of the acid, and the second by employing twelve or fifteen parts of acid. If the acid was more concentrated, a portion of the red oxide would be precipitated, and very little of it would be found in solution, if it contained from thirty-six to forty parts. This precipitation would not take place, unless the red oxide was very little divided: it is to this cause that we ought to attribute the inaction of the nitric acid upon colcothar, as well as the little action which sulphuric acid itself has upon this substance. What proves this is the property which these two acids have of easily dissolving the red oxide in the gelatinous state, or recently precipitated from the nitrate or muriate by alkalis.

We find in the other acids the same mode of action as in the sulphuric acid; but the generality of salts which result from them, being insoluble, are rather obtained by means of double decompositions than directly. I shall not here take notice of all the saline bodies, on account of the little interest they have hitherto excited in the arts and sciences; I shall only examine the two most important,—the gallates, which serve as the bases of the black dye; and the prussiates, the use of which has so much increased for these thirty years past.

We know that the gallic acid attacks iron even at the temperature of the atmosphere; that it dissolves it with the disengagement of that proportion of hydrogen gas necessary when water is decomposed; that this solution, at that time colourless, becomes blue very soon on its exposure to the air; and that then it begins to be thick, and passes to a blackish gray. All these phænomena have been described with much care by M. Proust, but to this moment the whole have not received a satisfactory explanation. I discovered the cause of their difference in the three oxides which iron is susceptible of forming. Thus, by pouring gallic acid into acidulated sulphate of white iron, no precipitate is obtained;

with the acidulated and acid
a precipitate of a fine blue ;
with a highly oxygenated sal
is of a black inclining to gra
hinders the deposition from
remark in the acidulated sul
addition of an alkali is indisp
gallate which then presents i
coloured flakes ; this is also
phate of iron, where the sat
for the precipitation of the
trary, does not take place in
is only a little acid.

The three oxides of iron of
and all of which may be cor
binations with the prussic ac
those we are about to exami
iron exist, neutral and with a
one and the other are suscep
siate of potash and forming
tallic prussiate predominates
form soluble salts when th
alkaline prussiate. Such, in
tory of Prussian blue ; but
to science not to consider pa
ponent parts.

One department of this hi
is the difference of colour in
composing solutions of iron
shades of these precipitates
times they are white, and s
they are more or less blue,
of colours recognises man
cipal colours. These effect
state of the oxidation of
the state of the alkaline pru

If the iron is little oxid
and the prussiate has an ex
will be obtained ; it will

other circumstances are the same, the prussiate is neutral; the one differs from the other only in the proportion of their constituent principles; the former contains an excess of oxide, while in the latter the acid is merely saturated with it. Thus the acids instantly render the prussiate of white iron greenish, by taking from it a part of its base; and the alkalis make the slightly green prussiate of iron pass to a white colour, by attracting to themselves a part of the acid which enters into its composition: thus by art we may transform these two salts, the one into the other at pleasure, merely by varying the quantity of the substances which form them.

These precipitates are not simple prussiates of iron, as has been believed for a long time; they contain besides prussiate of potash, as Berthollet has proved. The prussiate of potash has even so much affinity for the prussiate of iron, that the sulphuric acid only decomposes in part the insoluble combination which these two salts form together. If a slight excess of acid only is added, the residue still contains plenty of potash, and is perceptibly green; it becomes greenish blue by a greater quantity of acid, and, when analysed, little alkali and oxide is found in it: this attraction is still more striking when the prussiate of potash is abundant enough to render the combination soluble; then the sulphuric acid does not disengage from it even the most trifling smell of bitter almonds, and the sulphate of iron uniformly produces a very great quantity of precipitate; while, if the alkaline salt is pure, the carbonic acid is powerful enough to disengage the prussic acid from it.

The same results are obtained by substituting, in place of the acidulated sulphate of iron not much oxidated, the green acidulated sulphate of iron and the red muriate of iron which is only little acid: its precipitates are always triple prussiates of iron and potash; that one the oxide of which is green, is less blue than the one the oxide of which is red; both change colour if united with a great excess of oxide; the first becomes yellowish white, and the second reddish yellow; if the excess of oxide is less, they approach nearer to a blue colour; but both the one and the other are susceptible of being brightened by the acids.

Six prussiates of iron ther
racterized; three of them ar
cess of oxide; the excess of
siderable, which varies in
these prussiates. These six
bined with different quanti
without doubt also with the
a manner that this genus of s
It is generally observed that t
prussiate are soluble; those,
much prussiate of iron are i
sian blue becomes green by
then forms red oxygenated p
dinary prussiate of potash is
is thus oxygenated in wh
prussic acid acts upon the p
bined with it acts upon the
that the filtered liquor preci
of iron of a green colour.
solutions of prussiates, m
precipitate the sulphate of i
lour instead of a blue one.

It is this variety presen
sition, which renders thei
however, is not the only
nufacture of Prussian blu
others, which were only s
some of them even exist a
fections necessary to be att
save for other uses the gr
monia formed by calcina
prussiate of iron being us
commerce. I am convin
great care, that on calcin
as much carbonate of an
obtained as when such ani
selves; so that as much pr
carbon resulting from thei
ciples united. We may

same time with Prussian blue, and consequently double the products without much augmenting the expense of the manufacturer. The manufacturers of Prussian blue ought not only to direct their attention to this point, but also to several others which might improve their different processes. Some do not employ the most advantageous proportions of potash and blood, some do not add iron, and several maintain the heat too long: only a very few of them take the trouble of crystallizing the prussiate of potash; many of them do not know that in the calcination of substances the sulphate of potash contained in the potash made use of is transformed into sulphurets, and for a much stronger reason they are ignorant of the means of preventing the bad effects of it. In short, almost the whole of them consecrate too much time in oxygenating Prussian blue; by that means augment the manual labour, and deprive themselves of the power of making more considerable quantities of it. The prosperity of their manufactories depends, however, on all these considerations united.

The following is what I have remarked on this point:

Experience has proved to me, that a quantity of potash equal to that of blood was preferable to every other proportion; we know that the addition of iron favours the formation of prussiate of potash, and fixes it. It is not less evident that the effect of fire is also as important to observe, because, by exceeding the point of fusion, we decompose the prussiate of potash, or the matter which ought to form it. It is equally necessary to crystallize the prussiate of potash, particularly when we wish to obtain Prussian blue of a superior quality. On the one hand, we thus transform the sulphurated hydro-sulphuret of potash into sulphate of potash; and, on the other hand, it is only necessary to add very little alum in order to saturate the excess of alkali: we might again decompose the sulphurated hydro-sulphuret of potash by means of the sulphuric acid, because the acid does not alter the prussiate of potash combined with a certain quantity of prussiate of iron. This crystallization is not indispensable in the fabrication of common Prussian blue, into which much alumine enters, which cannot be separated

but by a great quantity of pot
liquor some time in order to b
besides, the sulphurated hydr
of the alum. In short, the
abridged, if, instead of wash
great quantity of water, it was
tity of oxygenated muriate of

Such are the observations
to collect in the present mem
long to my subject. In ord
I have connected with them
the result of the labours of d
I have even repeated facts kn
sent at one view the propert
ought to follow in an operati
examined, with some advanta
oxidation of iron and the co
acids. The existence of the
us acquainted with various p
were hitherto unknown; it
riety of colours which all the
It spreads some light on one o
dyes known, viz. that of blac
on the manufacture of Prussi
of which much yet remains t
concerns the art of obtainin
tion of which becomes daily

XLII. *On the Combination*
M. Th

I was led, about a year ago,
now about to communicate,
tempted to be introduced int
miraculous properties were i
cording to some accounts, i
in place of silver.

---

* From *Annale*

It was said to be very malleable; but, above all, its admirers boasted of its inalterability. By its appearance I thought that it contained plenty of tin; and as the price of it was moderate, I presumed it also contained antimony, and, to a certain degree, zinc or lead also. This was the reason why I treated 100 parts of it with the nitric acid. This portion of it was immediately attacked by a violent effervescence, and converted into a white powder. At the end of half an hour's ebullition, after having filtered the liquor, I tried it successively by the potash of commerce, the sulphuric acid, and the hydro-sulphurets.

All these re-agents having indicated that it contained nothing metallic in solution, I thought it very probable that this alloy was composed of tin and antimony alone. In order to ascertain this completely, I took the above white powder produced by the nitric acid, and I dissolved it in the muriatic acid. I concentrated the solution, and diluted it with water. It produced, as I had previously conjectured, a very abundant precipitate; but having allowed the liquor to settle a whole day, and having decanted it, I found no more metallic traces than in the preceding. Ammonia scarcely troubled it at all, and the hydro-sulphuret of potash gave it a slight yellow colour. Although I had performed the operation with much care, I could not at first give credit to this result, it appeared so singular, and it was only by repeating it that I found I was not deceived. What ought I to conclude from this? Had I consulted only the known properties of the oxides of antimony and tin, I should have been led to believe that the substance I had examined was nothing but antimony. It was however sensibly malleable, and must therefore have contained another metal. Every thing led me to believe that this was tin; and, in fact, I actually formed an alloy with antimony and tin, which enjoyed all the properties of the one above described. Four parts of tin and one of antimony give a very ductile alloy. Equal parts of each also give an alloy which possesses still a certain ductility. But if a few centiemes of lead enter into the tin, both the above alloys become very brittle. The intermediate alloys possess properties relative to the quantities

of tin and antimony wh
are not precipitated from
acid by means of water.
these limits are very dis
to contain one-third of i
property, particularly if
great measure driven off b
to notice that the precip
less than 24 hours, when
then the latter portions,
two oxides with the mu
and little.

This is not, however,
binations of oxides. We
tin does not combine wi
cining an alloy of three o
tin, it soon burns in the m
verted all at once into o
bustible than lead, far fro
menon, does not transf
long time, even by multip
air. I made several oth
oxide of antimony would
upon the oxide of tin. I
is the only one which th
precipitation, and that th
pitate any oxide along wi

After having thus pro
formed of tin and anti
the analytical means p
these two constituent
muriatic acid, which dis
attack the oxide of an
tion upon the alloy; an
I found antimony. I
knew that it would ea
timony; and that, on
pose but with difficult
tin. This method had

The liquor concreted in a mass, and did not admit of my obtaining the salt of tin by itself; and even the separation was far from being exact. I tried also, but always without effect, to volatilize the antimony, by heating the alloy strongly in close vessels. Finally, I treated the alloy with nitro-muriatic acid, and I did it in such a manner that the two muriates were highly oxidated. I distilled them in a retort, taking care to agitate it incessantly in order to avoid the boiling over, particularly at the end of the operation. I urged the fire even until the bottom of the retort was red, and I obtained sensibly all the muriate of tin. The muriate of antimony, which when highly oxidated is not volatile, remained in the retort. A very small quantity of this salt alone had passed into the receiver. The muriate of tin also is scarcely troubled by means of water. Although this process was perhaps not very rigorous, in order to separate the two oxides of tin and antimony, I look upon it as the best hitherto employed, and I consider it good enough to indicate how many centiemes of tin are contained in antimony, or *vice versâ*.

The consequences which may be drawn from this new fact, important enough to merit the attention of chemists, are evident. Is it well ascertained that the mines of antimony do not contain tin, and *vice versâ?* Certainly not, because the methods of analysis hitherto practised to separate these two metals have been inexact. Already have I searched for tin in sulphuret of antimony, and I never discovered a single trace of it; but I have not yet analysed any other ores of antimony, nor of tin. It is a labour which appears to me very useful to make, and which perhaps would furnish interesting results.

XLIII. *Abridgment of cert* *rent Magnitude of the ho* *sundry Times**. *To whic* *prove the Truth of the A* *clear Representation of th* *ciples. By* Ez. WALKE

To M

SIR,

WHEN the full moon is j
she is an object that pleas
time that she pleases the ey
barrasses his reasoning in
why her apparent magnitude
at higher elevations.

When men in former ages
nomenon, they imagined th
moon was really increased,
passing through the vapour
earth's surface. But as soo
subtended the least angle at
nitude was greatest, philos
posed upon by the long seri
the eye and the extremity
after it was discovered that
served at sea, where no l
blamed the clouds for decei
flew away, the spirit of inq
information in the apparent

Such were the erroneous
the greatest celebrity, both
To mention any more of
single quotation from Dr.
be quite sufficient to show
matter at the time when he

After the professor had

---

* In Mr.

phænomenon, he justly acknowledges that at different times the moon appears of very different magnitudes even in the same horizon, and occasionally of an extraordinary large size, of which he is not able to give a satisfactory explanation.—*Smith's Optics*, vol. i. p. 63, &c.; *Remarks*, p. 53.

It is really astonishing that this phænomenon should have remained for more than 2000 years without an explanation founded on a better principle than that of mere opinion.

That the dimensions of the pupil of the eye alter by the stimulus of light, is a truth well known; and it is also true, that the picture of the moon formed upon the retina is not permanent, but varies as the dimensions of the pupil vary.

To demonstrate this property of the eye, let ACB, (fig. Z, Plate VII.) represent a plano-convex lens; PA and RB two pencils of white or compound rays of light, falling upon it at the points A and B, in a direction parallel to its axis: also, let Axv and Byv be the red or least refrangible rays, and Aqy and Bqx the violet or most refrangible. The red ray from A will cut the violet ray from B at the point x, and the red ray from B will cut the violet ray from A at the point y; through these intersections draw the line xy, and this line will be the diameter of the least circular space into which all the rays that fall upon the lens parallel to its axis can be collected; and this circle, which for brevity's sake is called the circle of aberration, is the true focus of the lens, or place where the image of the object is formed.

Let the sine of incidence going out of glass be n, the sines of refraction (into air) of the least and the most refrangible rays be p and q; then if a plano-convex lens be exposed with the plane side to the sun, the diameter of the circle of aberration xy (or image of the sun formed of rays of different refrangibility) is to the diameter of the lens AB as $q - p$ to $q + p - 2n$*.

From this given ratio of AB to xy it follows, that the image of the sun within a telescope varies with the aperture of the object glass.

Sir Isaac Newton found, by most accurate experiments,

---

* This theorem is well known to mathematicians.

that where the sine of inciden
tion of the red and the violet
$q - p$ is to $q + p - 2n$ as 1
$xy :: 55 : 1$; or $xy = \frac{AB}{55}$

To elucidate this theorem
of the object-glass of a teles
contracted to three inches, an
diameters of the circles of abe
will be $\frac{4}{55} = {\cdot}072$, $\frac{3}{55} = {\cdot}05$

The same Property of Visi

Thus, let n represent the si
the sines of refraction, as befo

The sine of incidence of ev
tion in a given ratio *.

And the sine of incidence
with the aperture of the len
approaches the axis of the len

Therefore the sines of ref
xAy, and its subtense xy,
consequently, the image of t
increases or decreases in ma
eye.

Now as the rays of artifici
ole, it is evident from the giv
they increase or decrease at
of a candle formed in the fo
with the aperture of the glas
the light of a candle are both
the formation of images in t
does not obtain in the same
sequence of the rays of the
state than those of the form

Expe

To prove the truth of th
two double convex lenses,

---

* Newton

24 inches focal distance, and fixed them in a frame close to each other in the same plane. This instrument I placed in a perpendicular direction, with a white screen behind it, to receive the images of a lighted candle that stood before it at some distance. The screen being moved until the two images of the candle were seen very distinctly upon it, they appeared exactly of the same magnitude; but when the aperture of one of the glasses was contracted to an inch in diameter, the image of the candle formed by that lens appeared three or four times less than the image formed by the other; and as these two images were seen at the same time, the eye could judge more accurately of their dimensions than of the apparent magnitude of the moon near the horizon and on the meridian. But when I moved the screen until the circular spot of light or spectrum formed by the lens of four inches aperture measured one inch in diameter, the spectrum formed by the other lens measured only one quarter of an inch; and as the screen was moved from the glasses by slow degrees, the spectrums decreased in the same ratio, until two perfect images of the candle were formed.

Experiment II.

In order to exhibit a more exact representation of the phænomenon, I had a frame made to contain seven convex lenses fixed in the form of a semicircle. They were all of the same focal distance, but not of the same aperture. The two largest apertures measured each 1·2 inches; these were to represent the pupil of the eye when viewing the moon at her rising or setting; the two next to these had each an aperture of 0·6 inches; the other two were still less; and the single lens at the top of the curve had the least aperture, to represent the pupil when the eye is exposed to the moon on the meridian.

This instrument being fixed in a perpendicular position, with a candle before it, as in the preceding experiment, and the screen brought to a certain distance within the focus of the glasses, the spectrums upon it appeared in the same ratio to each other as the glasses that formed them. For a representation of these spectrums see Plate VI.

Hence

Hence the cause of that v
apparent magnitude of an ob
mere opinion; for it is an establ
image in the focus of a convex
ture of the glass, and consequ
in the focus of the crystalline
pupil is enlarged. I am, sir,

XLIV. *Extract of a Letter*
of Milan, to Professor Pic
duction of Muriatic Acid a
*composition of Water**.

SIR,

I HAVE a few words to say
at present occupies the attenti
and particularly Volta. It
compose the muriatic acid
vanic action. We have bee
which we are indebted to Dr
at Geneva†. The following
ceed at all times:

Have two piles, the one
gether at the base, in such a
of the one and the negative
superior extremities of the
platina wire from the *negat*
slightly closed at the top
through which the wire p
two-thirds of the tube.
substance also descend fr
into a tube B, disposed in th
Plunge both of them into
stilled water. Oxygen will

---

* From *Bibliotheque Britann*

† We do not believe it was

hydrogen in the tube A. Allow the apparatus to work, and a few hours will furnish unequivocal marks of the existence of the muriatic acid in the tube B; which had allowed oxygen to escape, and of soda in the tube A, which retained it. At the end of ten or twelve hours, nitrate of silver, poured into B drop by drop, precipitates itself abundantly. If the water of the two tubes is mixed together and evaporated, a sensible quantity of muriate of soda is obtained. If the experiment is made in the dark, the acid obtained in the tube B is oxygenated. The citron yellow colour is very striking; the smell of the acid cannot be mistaken; light decomposes it. The tubes must not be too narrow; they ought to be six or eight lines in diameter: without this precaution the experiment will not succeed; because the current, in order to pass from B to A by the inferior orifice of the two tubes plunged into a bad conductor, which is water, requires a cylinder of a great enough diameter in order to carry, in a given time, a sufficient quantity of electricity into the tubes. The latter must not be too far from one another; they will be at a convenient distance in a flat-bottomed drinking-glass. The oxygenated acid soon attacks the gold. If evaporated, we ought to have a fine purple of Cassius* for a residue. Has any thing been discovered for a long time more perplexing or more remarkable? The discovery of soda belongs to Mascagny, of Sienna†. I have the honour to be, &c.

LEOPOLD DE BUCH.

---

* The author is here in an error. There can be no precipitate of Cassius formed without the presence of tin.—EDIT.

† The production of soda by the Galvanic action is a new fact; but that of an acid (then supposed to be the nitrous acid) belongs to Cruickshank: he announced it very learnedly in a memoir entitled "Additional Remarks on Galvanic Electricity," published in Nicholson's Journal for 1800. What M. de Buch has here said relative to certain conditions of manipulation, without which the experiment did not succeed, will perhaps explain the reason why Messrs. Biot and Thenard met with no success in their attempts to repeat. —PICTET.

The production of soda by the Galvanic decomposition of water, was announced in The Philosophical Magazine so far back as the month of April last; that is, exactly a year ago. M. de Buch's letter given above is dated in October; and the number of M. Pictet's Journal, from which we have copied it, is that for November last. The first discovery, therefore, belongs to Mr. Peel. See our xxist volume, p. 279.—EDIT.

XLV. *Twenty-seventh Co*
TON, *relative to*

To M

DEAR SIR,

THE following cases of c
sidęrable importance, and r
journal.

Case of Catalepsy

Miss *Lavinia de Yrujo,*
Brook Green House, Hamn
years old: then her next at
when eight, they would atta
She used to faint; and her
clenched, and all her limbs c
remain wide open and fixed
of an hour. The last fit, b
October 1804, when it cam
seven. Mr. Flower was sen
the usual restoratives, and a
home for further advice. Sh
lon of vital air, diluted, on
remedies; and has not had
a whole twelvemonth. She
weeks, and has not had any
for any, since. She is nov
perfectly well; and is return
smith. The apothecary to
medical gentlemen, had pro
mily, this case as one that r

Observations on thi

1. These cases yield to th
dies fail. The cause is, tha
muscles, and thence to the
tion from an undue balance

2. And hence it is, that
become, on the contrary, c

XLVI. *Twenty-eighth Communication on Pneumatic Medicine, sent by Dr.* THORNTON, *from Mr.* HILL, *Surgeon.*

Case of Epilepsy cured by Vital Air.

CHARLES WAYTE DARE, son of Mr. Dare, Dowgate Hill, is a young man who appeared strong and healthy until eleven years of age. At that period, being very abruptly informed that his father's house was on fire, the shock affected him so much as to throw him into an epileptic fit. From this time the paroxysms failed not to return every three or four weeks; and though, during the course of some years, the number of his fits did not much increase, his bodily strength and mental faculties were considerably impaired. Several medical men were consulted on the first attack, but the remedies prescribed by them gave little or no relief. On his becoming deaf in one ear, and his eyesight failing him, whatever he learned at the Blue-coat School was forgotten, owing to the violence of the fits. His parents, therefore, thought it advisable to take him home. At length, having received some benefit from medical aid, his father placed him on trial at Mr. Davison's, in Sise-lane; but a fright soon bringing back all his former disorders, he was obliged to return again to his family. His fits were now exceedingly violent, and their frequency increased to a considerable number in twenty-four hours. In consequence of this he became more deaf than ever, his vision weaker, and his intellects so materially injured that it was impossible to leave him alone, for fear he should either fall into the fire, or meet with some other calamitous accident. In this truly deplorable state he was put under my care early in March 1796. The morning previous to my seeing him, his fits had been so particularly violent as to exhaust him greatly, and his pulse beat above one hundred in a minute. It was not without infinite difficulty that I could either persuade him, or make him comprehend in what manner, to inhale vital air from my apparatus; and the general torpor of his mind, extreme debility of body, and deafness, gave

me but faint hopes of his rec
inhaled a moderate dose of vi
fused itself over his whole fr
siderable degree of perspiratio
whole day, and the following
fits; a circumstance which
months. The next morning
hearing and vision less defect
beating ten strokes less in a r
On having again recourse t
before, and the second day
found a disposition to fulnes
dency to falling down durin
taken place, had not his ow
third morning, before he can
with a very slight fit. Findi
fulness in the head, I ordere
dicine. By paying due atte
and keeping the bowels prop
gular; while the active effec
his constitution, that he n
weeks gradually regained h
able to walk six or seven n
any inconvenience whatever
on in the month of May, h
ach, and some slight degre
to Hampstead; and for th
a trifling relapse. I now dir
on the temples, and to tak
dicine; after which, as soo
was to have recourse to t
intervals, until the middl
fectly well in health, stren
ber 1797 his father engag
kins and Lincoln, in Barbi
not having had any retu
plaints, he is fully enabled
a mind perfectly free fro
ritation.

"*To Mr. Hill.*

"SIR,

"I can with pleasure inform you, that my son, Charles Wayte Dayre, has, by the blessing of God, with your kind attention to him, and the help of vital air, received a very great cure from his fits, deafness, and nervous complaints, which had long affected him; and they increased on him so fast, that, when he applied to you, he had from sixteen to twenty a day. He could not be left at any time, even a quarter of an hour in a day. He has not had a fit these eighteen months, or near two years.

"I am, sir,
"Your greatly obliged humble servant,
"CHARLES DARE."

Observations on this Case by Mr. Hill.

However the general appearance of this young man may have been as to strength, some peculiarity of habit, as irritability of stomach and bowels, most likely had existed, and was a predisposing cause of the complaint. Be this as it may, any sudden surprise or misfortune will almost always produce some determination of blood to the head, more or less violent, in the strongest frame. In this case, as in many others, it laid the foundation of very serious mischief. In length of time it exhausted the nervous energy; and the powers of life, depending on an equable circulation, were reduced to extreme debility. Under these circumstances no remedy, one short instance excepted, arrested the progress of the disease, still less gave hopes of a recovery. The success in this case was beyond my expectation; for I was apprehensive that the several organs of sense, as the eyes and ears, were become paralytic from some organic defect in the brain, owing to the long continuance, violence, and frequency of the attacks. Contrary to my conjecture, however, the patient was relieved much in the same manner as the subject of the preceding case; and, as the same consequences followed, nearly the same reasoning applies to both;

viz. some accumulation in
chemical union of vital a
the skin and kidneys bein
strength of the nerves bei
recovered the chylopoietic

I cannot avoid particula
of the determination of bl
importance to all people su

XLVII. On the Electrogen
BERG, Vice-president o
tisbon*.

A GREAT deal has been sai
a chemist of Breslau, who
prize of sixty thousand fra
decreed to the author of th
The following is a succinct
lished on the subject, extra
M. Nauche, the physician,

M. Schmidt thinks he h
generating electricity, whic
serves, with caloric, to com
ples of the air—oxygen and
weakened by the presence
ment, on the contrary, it
reason why, in spring, el
unite with water, elevated
of elastic vapours.

The degrees of intensity
air and water are very vari
riations in the elasticity of

The sea, by surcharging
pours, absorbs electrogene
equilibrium. For a contrar
air a part of its electrogene

---

* From Biblioth. P

disengagement produce, by their succession, winds and clouds.

All the metals contain electrogene, and they do not oxidate but in regard to their affinity with it. It is the cause of crystallization by the dry method.

The weakening of the affinity of electrogene with the bases of the air, by means of the solar rays, gives birth to vegetation. Animal life is also attributed to electrogene. It enters with oxyen into the blood of animals by respiration; it is decomposed by this fluid, and its elementary base constitutes, in the brain and the nervous system, the principle of irritability.

M. Schmidt attributes still other effects to this new being; but he does not distinguish them well enough from those of caloric, oxygen, and attraction. His theory, although curious, is not sufficiently supported by facts to entitle it to much attention.

XLVIII. *Letter of M.* Orsted, *Professor of Philosophy at Copenhagen, to Professor* Pictet *of Geneva, upon Sonorous Vibrations* [*].

SIR, Copenhagen, May 26, 1785.

The impartial interest which you take in every thing tending to accelerate the progress of science, has made me desirous, for a long time past, of establishing a correspondence with you. I take the opportunity of a traveller going to Geneva, to deliver to you the results of some of my researches in physics. I have chosen as the subject of my present letter, the experiments I have repeatedly made, upon the effects produced in the interior of solid bodies during the propagation of motion. I have been led to these researches by both antient and modern observations upon sound. Every body is acquainted with the interesting dis-

---

[*] From *Bibliotheque Britannique*, vol. xxx.

covery of the celebrated Ch
ducing certain figures, b
metal or of glass, and then
a violin bow. The sand
the oscillations of the son
quitting certain parts of the
the others, by forming lin
The lines into which the g
are without doubt the poi
the surface put in vibratio
the edges of the plates.

Modern philosophers th
ous results, a confirmatio
exclude those internal vib
the cause of the phænome
merely to those oscillation
by their mechanical effect
sand gives an example.

It appears to me, howe
been abandoned too easi
rather led me towards th
from it. The following
experiments have suggest

It is allowed that in co
a sudden compression is
duces a dilatation, wh
neighbouring particles, a
propagate themselves in t
But I do not see why thi
solids, when they are m
periments of Chladni, alt
ous, are not proper to pr
cur to form the undulatio
tion result, and for the k
to him. Sand, which i
grained to indicate the n
moleculæ which trembl
these grains are elastic,

they fall, but fly about; this hinders them from pursuing a regular progressive movement, like that of sonorous undulations. It was on this account that, on varying my experiments, I thought of substituting in the place of sand, a more attenuated matter not possessing the inconveniences I have mentioned; this was *semen lycopodii,* or the seeds of club-moss. After having covered a plate of metal or glass with this substance, I tried to produce a sound in the manner of Chladni, and in an instant I saw the dust distribute itself into a number of little regular *tumuli,* which put themselves in motion at their extremities, or formed the figures discovered by this naturalist. They always range themselves in the form of a curve, the convexity of which is in proportion to the point touched by the violin bow, or towards the point which has an analogous situation: the nearer that each of these little heaps is to these points, its height is the more considerable; this gives to the whole a remarkable regularity. The experiments of M. Chladni are astonishing at first sight, on account of the regularity of the figures produced by a single stroke of the bow, which appears as if done by magic. My experiments have not the same charm; but perhaps they are more instructive, on account of the comparative slowness of my process, which admits of their effects being more advantageously studied. We observe that the interior of the small elevations formed in my experiments continue in motion during the continuance of the sound. The duration of these vibrations, although very short, is appreciable on plates of three or four inches diameter: it is longer when plates of a larger diameter are employed. I often made use of a disc of metal of six inches diameter: in this case I always saw the small elevations change their appearance at different epochs of the duration of the sound. At one moment the height increases, and at another it diminishes, and the dust has the appearance of arranging itself in small globules which roll one above another: we easily perceive that all these phænomena are still very complicated. The movement of the grains is in part vertical, in part horizontal; the horizontal movement is composed of two others; one of the forces impels the grains forward, and

the other drives them to th
amine, as minutely as poss
itself, and the following is
of glass in such a manner
it were in contact with my
I did not touch, with a
a manner that every point
instant. In this case, th
parallel to the edge struc
straight, because these ed
straightest I ever saw w
struck with a smooth piec
the better success of this e
square or the rule should r
not strike the blow upon
some of its points, other
direction of the blow, and
These lines seem to be co
tions, less regular than th
with the dust are struck
ment succeeds with diffic
allowed to rest upon a tab
vents us from striking a
the plate in a direction p
arranged itself in little re
the undulations proceed
take place both in a forw
third case, they proceed i
pression produced by the
propagates itself as well
tone produced in the fi
second is much more ele
much more elevated; an
to be called a tone, or a
scale.

One would suppose th
bodies, by the communic
limited to the simple me
but that in this modific

more intimate action. Every kind of friction produces not only heat, but electricity also. De la Place, and Biot, have already attracted the attention of philosophers to the first of these phænomena; I am of opinion that the latter of them requires much more attention. I always found in my experiments that sand, or dust, adheres much more to those parts to which the movement of the sonorous bodies had fixed it, than it did to the other parts. I have often thrown fresh sand over a plate of glass, upon which I had already produced a figure. I shook it gently after having reversed it, and I always remarked that the sand which formed the figure remained adhering, while the other part detached itself. The adherence of grains finer than those of sand is very remarkable. I also discovered, with the assistance of Coulomb's electrometer, indications of electricity in those plates which had emitted a sound; but I have not repeated these experiments sufficiently to enable me to detail them. I discovered on the above occasion, that the edges and angles of bodies act upon Coulomb's electrometer almost always; and I propose to myself a new course of experiments upon this subject. The celebrated Ritter, to whom I had communicated my experiments upon the part which electricity acts in the phænomena of sound, had long ago discovered that the electrical pile of Volta is capable of producing sound, when a shock is received from it in the ears. In a work about to appear under the title of "A System of Electrical Bodies," this great philosopher makes it clear that a body acquires positive electricity by compression, and negative by dilatation. Thus we may say, that there are in each sound as many alternatives of electricity, positive and negative, as there are oscillations; but the union of two electricities produces a commotion: thus there are in one sound as many extremely weak electrical commotions as there are oscillations. Each of these insulated commotions would be absolutely insensible; but when received in a very great number, in a period too small to distinguish the one from the other, they always produce a sensible effect, especially since positive electricity renders the organ more sensible for the negative than it was before, and *vice versâ*.

The sensible effect of t
motions is sound. I
appear contradictory to
of hearing; but it mus
of all the organs of
opinion, however, tha
fectly well with the
experiments, they may
some one perhaps may
scribed.

XLIX. On the Use o
mals.

The full use of the
skull which is called s
anatomy and surgery,
researches of the phys
in osteogeny, in a grea
of life, many uses hav
totally erroneous; suc
of moisture, to keep th
giving a more strict ad
surface of the skull; f
tion by blood-vessels b
of the head; or for aff
be pushed asunder by
gan should be crampe
comparatively slow gr

Other uses attribute
vantages derived from
early infancy, or till a
period. Thus at the
bones of the skull acc
figure of the different
passes. At adult age

---

* From *Manche*

they may occasionally check the progress (if I may be allowed the expression) of a fracture nearly spent;—or vibrations, communicated to the bones of the skull, will be propagated with less force to the brain, in consequence of the bones being separated at the sutures. It is, however, abundantly evident, that these are not the main purposes for which the sutures are formed; otherwise they would not begin to be obliterated at a period of life when they would perform these offices more usefully than ever. Consistent with this remark, we shall find that the true purpose for which they are formed, and the particular process with which they are connected, is fully completed before their obliteration takes place.

When we take a view of the mode of junction between many bones and parts of bones in the human body, which do not admit of motion, we find that with little exception they all agree in this particular; that sooner or later the cartilage or periosteum, which once was interposed, is obliterated, and these different portions, or entire bones, coalesce.

The separate portions, which originally compose the vertebræ, are early in thus uniting: after these the sides of the lower jaw; at a later period the epiphysis of a cylindrical bone is united to its body: and still later the bones of the skull usually coalesce, and the sutures are obliterated. Other bones, as those of the face, which have no motion and sustain little weight, are irregular in this respect; sometimes uniting, but generally remaining distinct to the end of a long life.

The original formation of the osseous system in several distinct pieces, respects principally its speedy ossification at an early period of life, and its future convenient extension, till it has arrived at its full growth; and we may consider it as a general principle, that where two parts of *one* bone are separated from each other by an intervening cartilage, or two distinct bones merely by periosteum, at that part osseous materials are added to increase their length or extend their superficies. This we shall find takes place, whether the junction be effected by comparatively smooth surfaces, as between the body of a bone and its epiphysis; or between

the bones of the skull by ja
that the bones of the body
or extent, not by a unifor
stance, but by an addition o
part.

Thus the body of a cylin
dition to each end. This v
case, from considering the
commences: as this comm
ceeds to each extremity, i
growth still goes on in the
the extremities. That this
reasoning alone, but by a
sunk two small pieces of
shin bone of a pig, and me
tween them: on examini
wards, it appeared, that th
siderably in length, the pi
same distance from each ot
this experiment we learn,
tended in its middle, but i
tremities, where the body
physis; the chief intentio
the intervention of a vas
ly deposit bony materials,
itself.

As cylindrical bones ar
we are led by analogy t
plan is pursued in the
body: and although we h
this has been proved, th
little doubt but they are c
Thus, to take the parietal
begins in a central point
rence, it is probable that,
continues to go on in t
circumstance taking plac
is probable, that even af

in bone, the addition is still made at the edge of each, and that the general enlargement originates where they are all mutually joined by the sutures. Of this process I had a very striking illustration some years ago. In a young subject, from what cause I know not, the deposition of osseous matter had been suddenly increased a short time before death. It was in different stages of progress, but had taken place in all the bones of the body which I preserved; in some partially, in others generally. In all, the new osseous matter was elevated above the level of the bone, upon which it was placed. In some parts of the parietal bones it was only in its commencement, and put on the appearance of a net-work, similar to that which may be observed in the same bones at an early period of their formation. In other parts the meshes of the net-work were more or less filled up; in others again completely, so as to put on the uniform appearance of solid bone. The same reticulated appearance was evident on the edges of all the bones of the skull, where they form the sutures, and at the extremities of the cylindrical bones, between the body and epiphysis. The same appearance of increased deposition was seen on the surface of the cylindrical bones, with this difference, that the meshes were not circular, but oblong squares; so as to put on more of the striated appearance. In some parts, the newly secreted bone was easily separable from the general mass, and formed a thin layer externally, affording one of the best proofs I have met with, of the increase of cylindrical bones in thickness by deposition externally, whilst a corresponding internal absorption goes on. From the striking similarity of appearance on the surfaces and edges of the bones, we may safely conclude, that the same process of deposition was going on in both, and may thence infer, that the bones of the skull are increased in extent by the deposition of osseous matter at their edges, or where they are joined to each other by suture. This fact points out to us, in a great measure, the real use of this peculiar mode of junction.

In order that the bones of the skull may be increased in extent, it is necessary that they should be retained at a certain distance from each other; that the periosteum with its

vessels may pass down betw
sion, and secrete the osseous
thin bones composing the up
an arch upon its basis, must
not to be separated by com
this purpose, projecting poin
each bone are reciprocally
niches; which only penet
thickness of the skull, and
tailing.

Two advantages arise from
and confined to the external
jecting points from each side,
of the internal table of the
effectually any violence wh
bones inwards; and the inte
by this means, a smooth s
brain; for internally no
is seen.

From this view of the subj
the human skull, by their p
the bones together, and so fa
interposition of a vascular o
is gradually increased to its

---

* Since this paper was written in
lar opinion was published by Prof
able work, "De corporis humani
which may belong to the primary s
As his opinion, however, has been
is placed in a clearer point of view
explanation of it to me, it has not b
place in these Memoirs. But whi
quotation, the near resemblance be
ring and that which I have brought
or compiler will not be attributed

"Usus horum sic sese habentium

"Incrementum ambitus calvariæ
partum suturæ interponerentur, h
natura rem instituerer. Tali igitu
mento reliquorum ossium convenit
tilaginosis ossa iis locis conglutinant

tion of the use of sutures comprehends and accounts for those concomitant circumstances, which were considered by older anatomists as their real use; and, as far as I can see, is not contradicted by any fact connected with them.

If it be asked, for instance, why at the sutures there is a stronger adhesion of the dura mater internally, and periosteum externally, than in other parts of the skull? the answer is, that these membranes with their vessels are continued into the sutures, to form conjointly the secretory organ by which the bones are extended.

If it be asked, why there is a greater vascularity or an appearance of blood-vessels passing through the sutures? it is perfectly consistent with this opinion to answer, that the increase of blood goes to this secretory organ, for the purpose of the extension of the bones.

The explanation here offered accounts also for the general obliteration of the sutures after a certain period of life; for, the bones having then arrived at their full size, the organ for the secretion of osseous matter is no longer needed; it shrinks and is absorbed, and the bones gradually coalesce; by which a further advantage is derived, that of an accession of strength to the cranium at large.

If any additional argument be necessary in support of this opinion, I may also notice the striking analogy which subsists between the separation of one bone of the skull from another by a suture, and that separation which exists be-

---

ad fonticulos, ut aiunt, hæc linea notabili latitudine, observatur. Ossibus enim capitis hic locorum cerebro crescente, placide quasi diductis, cartilago augetur, latior evasura, nisi pristina pars simul in os mutaretur, inde ossa calvariæ, eodem modo, quo ossa longa diductis epiphysibus, vel quod unum idemque est, marginibus crescere, liquet, etsi in ossibus longis sutura epiphyses inter et diaphysin non crispetur.

"Quo junior igitur infans, eo minus crispa et implexa sutura, vel, ut rectius loquar, linea cartilaginosa angusta, ossa jungens, observatur. Quum vero aucta ætate ossa, crescente cerebro, diducuntur, eorumque crassitudo, adposita cum internæ tum externæ potissimum tabulæ, (internæ enim incrementum citius absolutum videtur) massa ossea, augetur, non potest non esse, quin hæc crispa suturæ forma, quum quidem nasci cœpit, externa in superficie tamdiu augeatur, donec tandem ipsa ea quam maxime impediat, quo minus cerebrum calvariam ulterius diducere possit, quod pubertatis tempore accidit. Rarissime hæc ossificatio ad ætatem virilem usque detinetur."—Soemmerring De corporis humani fabrica, pag. 212.

tween the body of a cylindric
each remain only for a certa
the interposition of a secretor
obliterated, when the bones
have completed their growth
longer necessary.

L. *On the Existence of Ph*

By M.

THE discovery of a new ea
animals, is a fact in the histo
portant enough to deserve a
ed to promote improvements
covery has been made thes
and myself, in the course of
taken upon animal concretio
time to time given an accour

Having discovered, 1st, th
phate among the materials
bladder, and among the int
2dly, the phosphate of ma
property which characterize
the state of a triple salt ver
that the urine becomes am
composition; it appeared t
magnesian salt, unknown
quiries, was not to be found
began our inquiries upon b
the urinary receptacl is
The analysis of these organ
tion; and yet the new exp
the substance under examin
salt by methods and proces
those which have been hit
analysis.

---

* From *Annales du Mu*

In order to procure the magnesian phosphate in an osseous base, the bones of oxen, after being calcined white and well pulverized, must be treated with an equal quantity of sulphuric acid; after being allowed to rest five or six days the mixture is diluted, at first with ten times and afterwards with five times its weight of water. The liquor is drained every time; ammonia in excess is poured into all the liquors mixed together; and as these liquors, which were formerly supposed to be the phosphoric acid, contain phosphate of lime and phosphate of magnesia dissolved in the phosphoric acid, in proportion as the ammonia saturates the acid, a mixture of calcareous phosphate and ammoniacal magnesian phosphate is precipitated. This precipitate when washed with a little cold distilled water is treated with a ley of pure potash, by boiling them together until no more ammonia is disengaged. The ammoniacal magnesian phosphate is decomposed by this process. The ammonia volatilizes, the phosphoric acid unites itself to the potash, and the salt resulting from it remains in solution; the free magnesia deposits itself in powder, and mixes with the phosphate of lime at the bottom of the liquor. The latter is now drawn off clear, the precipitate is washed, and boiling distilled vinegar is poured upon it, which dissolves the magnesia without touching the calcareous phosphate; the magnesian acetate is decomposed by carbonate of soda, and we have the carbonate of magnesia, which is dried, of which the weight is determined, and which is dissolved in the sulphuric acid in order to obtain it in the state of sulphate of magnesia, the form under which it is more generally and more certainly recognised.

By repeating this process a great number of times, in the first place to ascertain the discovery of the phosphate of magnesia in the bones of animals, and secondly to appreciate the proportion of it, we ascertained that the acetic acid always dissolves a little lime with the magnesia, and that this lime could not proceed from any thing else than the decomposition of a small portion of the calcareous phosphate by means of potash: thus, in spite of the laws of affinities hitherto determined, it appeared evident that potash sepa-

rates

rates the lime of the phosphor
a very small quantity from it,
ployed by itself in a great qua
ash from the phosphoric acid
have here the effect of the p
Berthollet in order to explair
the action of the elective attra

Ox bones calcined contain
of magnesia.

Those of horses and sheep

Those of the feathered crea

We were not able to extr
quantity any thing equal to t

We have to remark on this
we had most frequently and r
to contain the following mat

Solid gelatine ....
Phosphate of lime
Carbonate of lime
Phosphate of magn

The phosphate of magnesia
arises from their food. No
in wheat, barley, oats, and
all the grasses named by Lin
of a centieme and a half of
double the quantity of the
contain. Without doubt, som
fact and those concretions f
mals, which are formed of
phate.

It is not impossible to con
contain phosphate of magn
more abundantly than the p
It appears that it is evacuate
have discovered it, while it
of such animals as throw it o

Without pushing too far
coveries upon the animal œco

various substances, we cannot pass over, in each of these discoveries, immediate applications, which ought no longer to be neglected. Physiology must necessarily derive great advantages from attending properly to such results.

LI. *Notices respecting New Books.*

A Treatise of Mechanics, Theoretical, Practical, and Descriptive. By Olinthus Gregory, *of the Royal Military Academy, Woolwich. 2 Vols. 8vo, and a Volume of Plates. Published by Kearsley.*

It is with much satisfaction we announce the publication of a work of this nature, which has been long wanted.

The first volume is devoted chiefly to theory; the second is practical and descriptive. The theoretical part is divided into five books, and these are subdivided into chapters, as the nature of the several subjects seemed to require.

Book I. is appropriated to the subject of statics, and is subdivided into six chapters. It commences, as indeed do all the books, with definitions and preliminary remarks; which are succeeded by a statement and illustration of the Newtonian laws of motion and rest, which are assumed as fundamental principles to guide the subsequent inquiries. The nature of statical equilibrium, with the composition and resolution of forces, are then discussed; forces being considered, 1. as disposed in one plane, and concurring in the same point: 2. as directed to one point, but not confined to one plane: 3. as situated in one plane, but applied to different points of a body: 4. as not confined to one plane, and directed to various points of a body. The remaining chapters in this book treat of the centre of gravity, and the centrobaryc method; the simple machines, or, as they are usually called, the mechanical powers; the strength and stress of timber and other materials; and the equilibrium, tension, and pressure of cords, arches, and domes. The minuter topics connected with these general points of inquiry cannot well be specified here.

The second book relates
six chapters; treating of m
descent and ascent of hea
motion of projectiles, with
descents along inclined pla
pendulums, and the curve o
the rotation of bodies abo
with theorems relative to th
percussion, spontaneous ro
matical theory of percussio
George Juan's Examen Ma
chines, and their maximum
marks showing in what
be considered by those w
their improvement.

Book III. is devoted to
divided into four chapters,-
fluids; the determination
and fluid bodies; the cons
meters; the equilibrium,
ing bodies, with a particu
boats; and on the phæn
tubes. This book contai
of specific gravities.

In the fourth book are gi
sitions and theorems relati
four chapters. 1. On the
tures in the bottom and
fluids: 2. An account of
losophers (as Bossut, Ve
&c.) on the discharge of
and the practical deductio
the effect of water upon t
account of Mr. Smeaton's

The fifth book, which
pneumatics, and contains
and discussed in this bo
fluids; the measurement
thermometer; the motio

pressure is removed; the theory of air-pumps, and pumps for raising water; the resistance of fluids to bodies moving in them; and results of experiments on the resistance of fluids.

The second volume of this work, which, as before mentioned, is chiefly practical, commences with an introduction occupying about eighty pages, and comprising general remarks, rules, and directions,—on the construction and simplification of machinery; on rotatory, rectilinear, and reciprocating motions; on bevel-geer, and proportioning the number of teeth; on friction and the rigidity of cords, with the experiments of Vince, Coulomb, &c., and an example of the power of the capstan, allowing for friction and the stiffness of cords; on water and wind as movers of machinery, with Smeaton's rules relative to windmills; on the strength of fired gunpowder; on steam as a mover of machinery, with the theorems and results of Bettancourt and Dalton; and on the strength of men and horses, according to the best and most accurate observations. The remaining part of this volume is appropriated to the description of a variety of mechanical contrivances, in number exceeding an hundred and fifty. These are arranged alphabetically, that they may be consulted with most convenience; and several of them relate to machines and instruments which have never before been publicly described.

In the exposition of the theory the author has generally proceeded by a series of connected propositions and dependent corollaries; those in each chapter having a manifest relation to each other, and flowing naturally from the same source. He has avoided the two extremes,—a fatiguing prolixity of detail, which leaves nothing to be filled up by the ingenuity of the pupil, and that obscurity which often results from the suppression of intermediate ideas. Mr. Gregory has not attempted to explain the *nature* of gravity, impulse, or the other sources of the motion of bodies; and the reasons he assigns in his preface are perfectly satisfactory. The general definition of the term *force*, in a mechanical sense, supersedes the necessity of inquiring into the essence of the various kinds of forces which may operate

upon matter. Those who
of that gradual refinement
the necessary demands occ
sation, will see how requis
ginally of a laxer or of a g
culiar modification of thou
as *power* and *force*, primar
are now, by a natural exter
analogy, employed to exp
philosophical acceptation, t
be that, whatever it be, " v
of a body, whether that
definition does not requir
disquisitions relative to the
tion of cause and effect: tl
by some cause, or somethi
occurrence, is a truth whic
but what is the agency, or
seldom know, except, pe
luntary actions. It is not,
nist, strictly speaking, to i
we learn, from universal ex
of animals, the operation of
pact, &c. are sources of mot
and hence, without pretend
of these, we do not hesitat
because it is incontrovertib
action of either, are put
their motion changed. F
us only by their effects, ca
they produce in like circ
be creating, accelerating, re
motions: and it is by comp
them to some common m
by ascertaining the essenti
chanics is made one of the

" Besides, what is mean
we are ignorant of its essen
and no other thing, we mu

covery of its qualities or properties; and it is the assemblage of these which is commonly called its nature: yet this is very inaccurate, since these are only the consequences of the essence. Hence we can give no definition of even the simplest of things which comprehends its real essence."

We have no hesitation in saying that this work cannot fail to prove extremely useful. The first volume, in particular, is executed in a manner highly creditable to the judgment and abilities of the author, who has rendered an essential service to his country by its publication. In praising in this particular manner the merits of the first, we would not be understood as meaning to censure the second volume: from the very nature of its contents it was impossible to infuse into it the mind which pervades the other; but the author has collected in it much useful information, which with less industry and judgment than he possesses could not have been brought together in the same compass. A future edition would probably be rendered still more valuable, by the suppression or alteration of a seemingly *ex parte* statement of the comparative merits of Mr. Watt's steam-engine and that of Mr. Hornblower; which however is not given in the work as the author's own production, but as from Mr. Hornblower, or some relative of the same name. Should the work meet with that reception which it merits from the public, we have no doubt but a new edition will soon be demanded.

A Treatise on the Teeth of Wheels, Pinions, &c., demonstrating the best Forms which can be given to them for the various Purposes of Machinery, such as Mill-work, Clock-work, &c.; and the Art of finding their Numbers. Translated from the French of M. Camus; with Additions. Illustrated with fifteen Plates. Published by J. Taylor, Holborn.

This work is a translation of the tenth and eleventh books of M. Camus's *Cours de Mathematique*. The abilities of the author are so well known to the learned world, that nothing that can be said here can add to his fame; and it is but justice to the translator to say, he has executed his

part with fidelity, and in a
is of much more importance
can possibly conceive, that
wheels should be ascertained
ples. Where this is not atte
unnecessary load on the mac
tion, a consequent waste of
tionate expenditure for repair
noticing that there is a mani
text of this work, and an illus
epicycloid to the teeth of wh
latter directs the epicycloid c
primitive diameters of the w
other; the former directs the
equal to radius only of the
doubt not, will be found v
procure to the publisher a p
has rendered to the public
dress.

The Vaccine Contest; *or* "
gion, and Truth, against
bearing Influence, mortifie
speration," &c. *By* Wı
of the Lock Hospital, &c.

In this work, designed for
families, and other unprof
tempts to answer the obje
quite a new plan; viz. by
making them refute themse
to say, he has effectually s
a very fair exposure of the u
anti-vaccinators have resort
ignorant into a source of
selves.

Doctor Patterson, of L
with the importance of th
searches concerning Pestil

with a View to obtain valid Principles whereon to found a Civil Constitution of Medical Police for Ireland."

To every one conversant in this field of inquiry, it is manifest, that the climate of the country, the physical and moral attributes of the inhabitants, their political and commercial relations, their œconomical institutes, and other corresponding circumstances, must be taken into consideration in a work of this description. It will also be necessary to take a retrospective survey of the numerous malignant and reigning distempers which have prevailed in many parts of the earth throughout a series of ages. These are not easy tasks—they are not small undertakings: yet, difficult and extensive as they are, little short of their achievement will answer the purpose; a purpose which has in contemplation objects of the first national importance.

Mr. Rudge has just published the Fourth Fasciculus, which completes the First Volume, of his Descriptions and Figures of the Rare Plants of Guiana.

The plants described in this work formed a part of that superb collection of natural history consigned from Cayenne to the National Museum at Paris: they were five years collecting in Guiana, by order of the French government, and were captured on their passage by two British privateers at the commencement of the present war.

We understand that only 150 copies of this work will be published.

LII. *Proceedings of Learned Societies.*

ROYAL SOCIETY OF LONDON.

March 27. The Right Honourable President in the chair. —The reading of an interesting paper, consisting of observations on the marine barometer and thermometer, made by captain Flinders, on the coast of New Holland, in the years 1801, 1802, and 1803, commenced, and the society adjourned, in consequence of the Easter holidays, till the

17th of April. The President in the chair.—Continuation

of the above paper, contain
facts of the most extraordin
tions or stagnations of the
thermometer.

On that evening Messrs.
M. Prevot, of Geneva; and
men, the discoverer of the
fellows of the Royal Society

April 24. The President i
captain Flinders's meteorolo
author seemed to believe that
data to enable him, with a se
ticate truly the general state of
or continuance of a storm, by
observations. This desidera
sphere of human science, ar
tion and industry, only in the
captain of a vessel would best
captain Flinders, and comm
equal promptness. The num
of our naval officers render
not before this time collected
the philosopher in his cabine
a practical system, that woul
cipate the direction and stren
tude, and at all seasons of the
the present moment, a great de
among individuals of our sea
meteorologists, and equally ur
from diffidence in the observe
tions.

It may not be improper to
marine atmosphere, not obse
facts, nor perhaps by any
air or wind always traverses
bodies, and in parallel lines
are few exceptions, that a c
its direction or velocity, uni
sea, till it is either entirely a

by rarefaction. The reverse is the case on land; as no current of wind can pass many miles without experiencing a change of temperature, density, velocity, and even direction, in consequence of the variegated surface and temperature of the earth. The rencounter of two opposite currents of wind, at sea, does not produce the effect proper to solid bodies in motion, according to the received laws of mechanics; on the contrary, as their temperatures and densities must necessarily be different, each pursues its undeviating course without any change, excepting only that the least dense is obliged to ascend and make room for the other, which keeps next to the surface of the water; notwithstanding which, each proceeds with nearly its original velocity. Two currents of air, whatever may be their temperatures or densities, never incorporate either by sea or land, without the intervention of a third body (such as mountains, &c.), which destroys their respective velocities. No such resisting bodies being at sea, the different currents of wind must consequently follow the law of their densities. Parallel currents often occur in very short distances, and the intervening spaces frequently experience dead calms, sometimes accompanied with fogs, or with unclouded brightness, and considerable heat. This circumstance will, on many occasions, account either for the stagnancy or rapid fluctuation of the mercury in the barometer at sea; which can never happen, even in the warmest or most electrical climates, on shore, where there is a much greater and more general sameness of density and temperature in the atmospherical currents, in consequence of the greater facilities of commixtion, and often, indeed, of chemical union of the different gases.

For these remarks, which form no part of captain Flinders's communication, we are indebted to a gentleman who has made a number of observations on this important subject. Should any of our nautical readers, or others who may have had an opportunity of making similar observations, communicate to us the result of their experience*, we shall gladly lend our aid to the collecting of such facts

---

* Addressed to the Editor of The Philosophical Magazine.

as may tend to the elucidation
them a place in our work.

A letter from Smithson Ten
was read, announcing his discov
vein of galena in Devonshire.
native minium was found in th
galena, accompanied with crysta
chemist promises to forward spec
mineralogical friends, for their p

LONDON INST

A general meeting of the pr
was held on the 24th of April, at
to receive a report from the mana
posed to be applied for, to obtai
of a corporate body.

A draft of the proposed charte
which, after some discussion, w
the use of the proprietors, and to
deration at a future meeting.

The meeting then proceeded
officers, &c. of the institution,
of their names in the proposed c
gentlemen were elected:

President—For

Sir Francis Baring, ba

Vice-Presidents—

Sir Richard Neave, ba

For Three

Beeston Long, esq.

For Two

George Hibbert, esq.

For one

John Julius Angerste

Managers—Fo

Richard Clark, esq.
Rev. Matthew Raine,
Richard Sharp, Esq.
John Smith, esq. M
Henry Thornton, es

For Three Years.

Jeremiah Harman, esq.
Benjamin Harrison, esq. F.A.S.
William Hasledine Pepys, esq.
John Rennie, esq. F.R.S. F.A.S.
Robert Wigram, esq. F.R.S. F.A.S.

For Two Years.

Thomas Bodley, esq.
Charles Bosanquet, esq.
John Peter Hankey, esq.
Joseph Huddart, esq. F.R.S.
Job Matthew Raikes, esq.

For One Year.

Thomas Baring, esq.
Samuel Boddington, esq.
Nathaniel Bogle French, esq.
William Henry Hoare, esq.
Abraham Wilday Robarts, esq.

Visitors—For Four Years.

Sir John William Anderson, bart. M.P.
Henry Hoare, esq. F.A.S.
William Saunders, M.D. F.R.S. F.A.S.

For Three Years.

Sir William Blizard, F.R.S. F.A.S.
Sir Charles Price, bart. M.P.
Right hon. the lord mayor, James Shaw, esq.

For Two Years.

Thomson Bonar, esq.
Harvey Christian Combe, esq. M.P.
Sir Hugh Inglis, bart. M.P.

For One Year.

Charles Grant, esq. M.P.
Robert Hankey, esq.
William Manning, esq. M.P.

Auditors—For one Year.

Isaac Lyon Goldsmid, esq.
Thomas Hughan, esq.

John Inglis, esq.
Thomas Reid, esq.
William Salte, esq.
Treasurer—F
Sir Willam Curtis, b
Secretary—Fo
Samuel Woods, esq.

ROYAL COLLEGE OF S

At the meeting of this body
(instant), the Jacksonian prize f
Hyslop, esq. of Fenchurch-st
dissertation on "Injuries of
lence."

There are two prize subjects

1. The diseases of the joints,
and the best mode of treatment

2. Herniæ, and the best mo

The dissertations are requir
Christmas 1806.

SOCIETY OF A

March 27. The right hon.
dent, in the chair. An old p
real portraits, placed around a
money, which was marked E
three old gentlemen seem
from their dress and characte
painting must have been exe
Elizabeth. The learned presi
correct notions of the charact

Drawings of some more
were also exhibited.

April 17. The president i
bited some excellent drawing
displaying almost every styl
used in this country.

A letter to the president f
Good Hope was read, conta

English inscriptions found on stones there, relating the arrival and departure of sir Henry Middleton's fleet of East India merchantmen in 1604 and 1609, being the fourth voyage to India. The inscriptions were on stones placed in a conspicuous part of the shore, and designed merely as a notice for other English ships that might touch there, where and when any others might probably pass. The same writer mentions, that he saw the fluke of an anchor on the summit of Table mountain, a height at which no human effort could likely have placed it.

The right hon. lord Hutchinson was elected a fellow of this society, which was adjourned till the anniversary on the 23d of April.

On the 23d of April, being St. George's day, the society of antiquaries met at their apartments in Somerset-place, in pursuance of their statutes and charter of incorporation, to elect a president, council, and officers of the society for the year ensuing:—whereupon

George, earl of Leicester,
William Bray, esq.
Rev. John Brand, A. M.
Sir H. C. Englefield, bart.
Rev. Dr. Hamilton,
Samuel Lysons, esq.
Craven Ord, esq.
John, lord bishop of Salisbury,
John Willett Willett, esq.
Joseph Windham, esq. and
Rev. T. Wm. Wrighte, A.M.

eleven of the council, were rechosen of the new council; and

Edward Astle, esq.
James Bindley, esq.
Francis Douce, esq.
Charles, duke of Norfolk,
Hon. John Peachy,
John Sylvester, esq.
John Wilkinson, M.D.
Henry Norton Willis, esq.
Hon. Brownlow, lord bishop of Winchester, and
Chas. Wat. Williams Wynne, esq.

ten of the other members of the society, were chosen of the new council, and they were severally declared to be the council for the year ensuing; and on a report made of the officers of the Society, it appeared that

George, earl of Leicester, was elected president,
William Bray, esq. treasurer,
Samuel Lysons, esq. director,

Rev. Thomas William Wri
Rev. John Brand, A.M. se
The society afterwards dined
Anchor tavern in the Strand, ac

FRENCH NATIONA

The class of history and of an
National Institute lately held a
distributing the annual prizes.

One of the subjects which ha
lowing:

“To examine what was th
from the conquest of that count
of Alexandria by the Arabs;
changes which it experienced d
dition of the Egyptians; and t
dition of strangers domiciliate
the Jews.”

Of all the memoirs sent to th
to possess sufficient merit to o
was therefore again given out f
of July 1807.

The class then proposed, as t
be adjudged in July 1808, “to
influence of the crusades upon
of Europe, upon their civilizat
their learning, commerce, an

The prize offered is a gold m
and the discourse, which mus
be given in before the 1st of A

IMPERIAL ACADEMY OF SCI
THE FINE A

This academy, formerly th
which was new modelled in c
annexed to France, has pub
memoirs for the years 12 and
appropriated to the labours of
Fine Arts; the other, compil
Eandi, mentions the changes
list of academicians, the vari

and the presents made to the academy. After this follows an account of the labours of the academy up to 1805, which occupies 250 pages, and then the different memoirs, viz.

1. Description of a new portable barometer for measuring heights and depths, with observations made with it in the circles of Turin and Saluzzo: by Vassali Eandi.

2. Account of a waterspout that occurred in the territory of Revel, in the circle of Saluzzo, March 27, 1798; with remarks on the cause of the phænomenon: by the same.

3. On the different capacities for conducting heat, ascertained, by experiment, in different articles used for clothing: by J. Sennebier.

4. Of a new species of hawkweed (*crepis*), to which are added some cryptogamiæ of Piedmont: by J. Baptist Balbis.

A figure of this plant, which Mr. B. calls *crepis ambigua*, is given. Among the cryptogamiæ are the following new species: *mucor flosculentus, peziza amentacea, lichen nivalis.* These likewise are figured.

5. Experiments on the effects of the nitric and oxygenated muriatic acid, employed topically in the treatment of various diseases: by M. Rossi. Mr. R. gives an account of the cure of several gangrenous ulcers, venereal buboes, and even contagious carbuncles, effected by the application of these acids.

6. Meteorological observations made during the solar eclipse on the 30th of January 1805, at the observatory of Turin; with reflections on them: by Ant. Mar. Vassali Eandi.

7. On a species of cassia, that may be substituted for the senna of the shops: by M. Bellardi. This is the *cassia marilandica*, which Mr. B. would call *succedanea*, because, according to him, it may supply the place of *cassia lanceolata*.

8. Inquiries into the nature of the Galvanic fluid: by A. M. Vassali Eandi.

9. On the mines of plumbago in the departments of the Sture and Po: by M. Bonvoisin.

10. Attempts to improve nut oil: by the same. Mr. B. points out a method of purifying this oil, and rendering it as fit for lamps as other fine oils.

11. Examination of the act
different gases: by J. A. Giob

12. An anatomical and phys
atic glands: by professor Rossi

13. Solution of a problem
permutations and combinations

14. Explanation of the circu
sionally found with prickles in
division: by M. Giorna. Thi
the male only has prickles, an
time.

15. A chemico-medical essay
tion, by Jos. Hyac. Rizzetti.
essay is the nature of the matte

The following papers are by

1. Memoir on the use of var
summing up equations with
Brunacci.

2. A systematical enumerati
the territory of Saluzzo, with
To this catalogue are annexed t
lowing new species. *Coccinel*
curculio spinosus,—c. dubius,—
tus,—c. melanocephalus,—chr
variegata,—ch. pretiosa,—ch. li
—cantharis impressifrons,—
silphoides,—tenebrio rufus,—bi
tus,—c. metallicus,—c. Rossii,-
sinuata,—s. scabra.

3. On the motion of the hai
by Palamedas de Suffren. Pa
already been observed in th
De S. has found it in those of
all the singularities of the pha
companied with a plate.

4. Of a resin employed b
combs. By Fr. Mouxy Del

5. Entomological observat

first sketches the history of the silkworm; and then proceeds to certain hymenoptera, chiefly of the genera *tenthredo*, *ichneumon*, *sphex*, and *vespa*.

6. Specimen of the fungi of the vale of Pisa, by Hugh Camino. The new species are figured on three plates. They are Agaricus elatior: a. miniatus: a. pezizoides: a. atrosanguineus: a. tricolor: Boletus scobinaceus: Helvella grandis: h. reflexa: h. inflata: Peziza ochracea: p. pyriformis: Reticularia rosea: Mucor fruticulosus.

7. Observations on the native gold found among sand, by Lew. Bossi, of Milan.

ACADEMY OF GENOA.

On the 26th of January last this academy had a public meeting, which was attended by the chancellor of the exchequer Le Brun, member of the French National Institute, and other distinguished inhabitants. M. Cotardo Solari opened the meeting with a discourse on the following subject: "That learning, when not regulated by wisdom, is productive of more injury than benefit to a state." The following prize questions were afterwards announced:

1. Has any other of the heavenly bodies, besides the sun and moon, any influence upon the meteorological appearances of the world?

2. Which is the best method of rendering the harbour of Genoa more secure and convenient for shipping?

3. Whether is it more advantageous for the inhabitants of the Ligurian republic to encourage the wine or oil trade? and what is the best method of cultivating the vine, and the plants which produce oil?

The prize for the best answer to each of these questions is a gold medal of 400 ducats in value: the second best discourse will be rewarded with a silver medal. The discourses must be given in on or before the 15th of November next.

VACCINE-POCK SOCIETY, AMSTERDAM.

This society lately held its annual sitting; when it appeared that out of 1800 persons inoculated with the cow-pock during the years 1804 and 5, not one had died, or taken the small-pox.

MEDICAL

MEDICAL SOCIET

This society has announced t
“ What are the diagnostic and
the state of the tongue, the lips
chronic disorders ? and what ad
tice from this discovery ?”—The
francs in value. The answer m
August 1807.

ŒCONOMICAL SOCIETY OF

This society has been present
with a hundred acres of ground
dence, for the purpose of found
erecting a house wherein the so

AMERICAN S

Since Louisiana was added to
America, two learned societies
strict, at New Orleans and Na
called “ The Literary Society
journal, particularly intended t
country to other nations, an
useful learning. The literary
blished in Oct. 1803, and is cal
for the Discovery and Extensi
consists of between 30 and 40
in the several united states, a
own : both the above societies
rican government.

LIII. *Intelligence and*

AEROST

THE ninth aërial ascension an
place last Monday, (the 7th in
the circus of this city, in pres
spectators. From day-break t

ed in the production of hydrogen gas; the sky was serene, and at mid-day the operation of filling the balloon was completed and every thing ready. M. Mosment leapt into the car; and upon a signal being given the balloon was set at liberty, and ascended very rapidly into the air amidst the shouts of the spectators. M. Mosment repeatedly waved his flag as he ascended, which was adorned with the imperial eagle. The wind was northerly, and the balloon was carried gently before it. At a certain height the aëronaut let go a parachute to which an animal was attached, and the experiment succeeded admirably. In the mean time the balloon continued to ascend, and appeared as if exactly above the town. At one o'clock it seemed to have encountered some adverse winds. Something red was then seen slowly descending, which was picked up, and found to be the flag which the aëronaut carried up with him. This however excited no disagreeable emotions, and all eyes were turned to the balloon, which soon ascended to such a height as to become invisible. The crowd then began to disperse, perfectly satisfied with the success of the experiment; but a rumour ran through the populace, that the dead body of a man had been found dreadfully mangled in one of the fossés of the town. This excited some inquiry; and upon inspecting the body, it was found to be that of the unfortunate aëronaut, but so covered with blood that it was with difficulty he was recognised.

This event gave rise to various conjectures; but it is generally supposed that the car was too shallow, and that M. Mosment had fallen asleep, as often happens to aëronauts when in certain regions of the air, and had been shaken out by the violence of the winds. It is possible also that one of the cords may have slipt, and that M. Mosment losing his balance had fallen out. The balloon has not yet been found; which prevents the real cause of the accident from being ascertained.

ICELAND.

The Danish government is occupied in the amelioration of the lot of the inhabitants of Iceland, a people removed to the confines of the polar circle, but interesting on account

of the zeal with which they cultiva
and 11th centuries, and on accoun
to America. Iceland, almost ruin
political misfortúnes, is about to
is building, to be called *Reykiavi*
by colonies of natives as well as s
the vessels of commerce; and a c
tient languages and natural histo
exercise of its functions.

NEW MUSICAL IN

M. Diez, at Emmerich on the
musical instrument, which he ca
less room than an ordinary piano
any common performer, after a
distinguishes it above all other
the circumstance of its producing
hautbois, and bassoon, in the so
liant forte movements. The co
about 40 louis d'ors.

ANTIQUI

A letter from Petersburgh, of
the discovery of two great citi
which no traces can be discover
in the Isle of Taman in the Bl
strict in Siberia.

CHEMICAL AI

An intelligent corresponden
ham, the proprietor of a chemi
bourhood, in which many artic
manufactures of this kingdom
scale, has communicated to u
the attention of chemists.

Contrary to the common tal
copper may be precipitated f
phuric acid by tin. All that
the experiment is, that the sol
point, or actually boiling, whe
tin made use of ought to be i

to thin fragments by pouring it, when in fusion, into cold water.

To the enlightened chemist we need not point out the experiments suggested by this new and curious fact, and the important results to which it may ultimately lead. If copper and tin, by a mere difference in the temperature of the solution, may be made mutually to precipitate each other, it is not impossible that the order of affinities with respect to other metals for the different acids may also be inverted by circumstances connected with temperature. Should any such results be obtained, they will be productive of incalculable advantages in many intricate cases of analysis. The different results obtained in apparently similar experiments, by equally accurate chemists, may perhaps have been owing in some cases to the existence of such a law as we now allude to.

MINERALOGY.

Dr. Aires, from New Jersey, who has lately explored several of the western counties of the State of North Carolina, in search of gold, reports, that he has discovered gold in branches and creeks in the counties of Cabarrus, Montgomery, and Randolph, in a north and north-east course, and in the county of Mecklenburgh, in a south and southwest direction from the first sound, where none had ever been discovered before, except in three or four branches near Reed's (the first discovery) in Cabarrus county. A few pieces of gold, intermixed with stone, have been found on the surface of the earth, and some ploughed up in most of the said counties. Several of the said water-courses contain considerable quantities of gold dust, which can be collected by washing the sand, after the first or common washing, with a machine proper for the purpose, and then by mixing mercury with the sand thus washed, which will unite with the particles of gold, and form an amalgam, whence the mercury may be driven off by heat.

A copper mine has been discovered on the estate of Hans Hamilton, esq., in the county of Dublin, which promises to be very productive. A company has been formed, and are already engaged in carrying it on.

TRA

The Polish Prince Alexan
geological and archæologica
his estates in Poland for the
treasures of art and science
longest stay was at Athens, v
preserve many of the last ra
antient Greece, in their nativ

The embassy to China left
nese frontier town, in Decem
120 persons; the rest of the
are already arrived in Russia. S
200,000 rubles in value, goin
by the Kingise. The chiefs
good the loss amicably.

The South American Socie
have received intelligence that
bassador to Japan, has not ye
of the sovereign, but that he
received; the presents of whi
been accepted, and an exch
scription.

ANALYSIS

Dr. Menuret, of Paris, ha
waters in that neighbourhood

The water of the Seine c
matter in each pint. That of
$\frac{11}{13}$; that of the Arceuil, 7 gra
9 grains $\frac{88}{49}$. Bristol water co

Thus, of all the waters drun
the most salubrious, the pure

SURGICAL IN

Drs. Faust and Hunold are
they endeavour to prove, tha
lancet used in inoculation, ev
to be dipped in oil before pr
should also be heated to the

these precautions they contend that the pain of the operation is always diminished.

A REMARKABLE HEN.

For the three last summers, a hen, the property of Charles Ranken, at Auchinairn, parish of Cadder, has frequently laid eggs of an extraordinary size and weight. Within these few weeks, she has laid three eggs, each of which measures in diameter 6¼ inches by 7½, and weighs fully 3¼ oz.; and generally, on the day before she lays the large egg, she lays an egg of an ordinary size.

LECTURES.

Mr. Taunton's next Course of Lectures on Anatomy, Physiology, and Surgery, will commence on Saturday the 24th of May, at 8 o'clock in the evening, at his house in Greville Street, Hatton Garden.

LIST OF PATENTS FOR NEW INVENTIONS.

To Samuel Miller, of the parish of Saint Pancras, in the county of Middlesex; for various improvements in the working of coal, tin, lead, and other mines, by which there will be a great saving of fuel and labour, and many accidents prevented. Dated April 1, 1806.

To James Keir, of West Bromwich, in the county of Stafford, esq.; for his improved method of manufacturing white lead. Dated April 3, 1806.

To William Henry Lassalle, of the city of Bristol, apothecary; for certain improvements in soap. Dated April 5, 1806.

To James Kay, of Preston, in the county of Lancaster, machine-maker; for improvements upon Thomas Johnson's patent machine for dressing cotton, silk, and other goods by power. Dated April 17, 1806.

To Thomas James Plucknett, of the parish of Christ Church, in the county of Surry, agricultural machine maker; for a machine for dibbling and drilling all kinds of grain and pulse. Dated April 17, 1806.

METEOROLC

By Mr. Carey,

For Ap

Days of the Month.	Thermometer.		
	8 o'Clock, Morning.	11 o'Clock, Night.	Noon.
March 27	46°	47°	42°
28	41	42	40
29	39	43	39
30	39	46	38
31	40	47	38
April 1	36	42	34
2	35	42	34
3	35	41	35
4	35	40	36
5	39	48	41
6	46	54	42
7	47	55	39
8	39	55	42
9	46	56	40
10	44	46	38
11	35	41	34
12	33	34	29
13	33	34	33
14	35	38	34
15	34	39	34
16	34	49	40
17	40	55	45
18	46	58	49
19	49	59	52
20	52	61	52
21	52	57	48
22	49	55	45
23	44	49	43
24	44	51	46
25	46	51	40
26	40	44	38

N. B. The barome

LIV. *On Transit Instruments.* *By* Ez. Walker, *Esq.*

To Mr. Tilloch.

SIR,

Astronomers have, in all ages, been very attentive to the construction of instruments for determining the exact time when the sun, or any other celestial luminary, passes over the meridian. The best instrument that has yet been invented for this purpose, is the transit telescope; but the difficulty of procuring a proper foundation to fix it upon, and the expense of fitting it up, must render its use extremely limited. Clocks and watches may be regulated for occasional observations, by means of equal altitudes of the sun or stars, taken either with an astronomical quadrant or a Hadley's sextant: but these methods are very inconvenient for keeping the daily rate of a time-keeper, in consequence of the length of the calculations, and the time that is required for taking the observations. Hence it may be presumed, that an instrument for finding the exact time of noon in an easy manner, is still wanted, to supply the place of the transit telescope.

The method used in former ages for resolving this problem has, perhaps, been too much neglected since the time that the science of optics began to receive so many improvements. The method to which I allude is that of finding a meridian line by means of the sun's rays transmitted through a small circular aperture made in a piece of metal. In this manner, a kind of transit instrument may be constructed, at a small expense, in many situations that afford no foundation for a transit telescope, and to a greater degree of accuracy than may, perhaps, be generally supposed.

Having, some years ago, drawn a line by this method, and being desirous to know how far it deviated from the true meridian, I took 14 equal altitudes of the sun from the surface of a fluid with one of Mr. Stancliffe's best 12-inch sextants. The time of noon, derived from the mean of those observations, differed only 2·27″ from the time that the sun passed over the meridian line on the same day.

But in order to observe the sun's transit over the meridian with greater precision, I drew two other lines on each side of the meridian line, which were parallel to it, and at such distances, that the interval of time taken by one of the limbs of the sun's image was about 40 seconds in passing from one line to another, when the sun was near the equator. Those who are at all acquainted with the use of the transit telescope, will be at no loss to comprehend the use of these lines; and those who may want directions for the use of that instrument, may consult a treatise on the method of finding the longitude at sea by time-keepers, written by the late Mr. William Wales. To those directions I shall only add, that the room in which the lines are drawn must not be made too dark during the time of observing, as it is necessary to see the lines before they are illuminated by the sun's image.

When the solar rays, that flow through a small circular aperture into a room, are received upon the floor, an elliptical image will be formed, consisting of a bright central image, and a penumbra surrounding it. This penumbra renders the contact of the sun's image with a line less certain: but, notwithstanding this inconvenience, I am convinced that an experienced observer, under favourable circumstances, will generally determine the time of the sun's passage over the meridian line to one-fifth of a second, or less, when the distance between the aperture and the sun's image on the floor measures about 12 feet. Further particulars respecting the construction and use of instruments of this description will be submitted to your inspection at some future opportunity.

I am, sir,
Your most humble servant,
Ez. Walker.

Lynn, May 8, 1806.

LV. *Account*

LV. *Account of a Series of Experiments, showing the Effects of Compression in modifying the Action of Heat. By Sir* James Hall, *Bart. F.R.S. Edin.*

[Continued from p. 208.]

IV. *Experiments in Gun-Barrels resumed.—The Vertical Apparatus applied to them.—Barrels bored in solid Bars.—Old Sable Iron.—Fusion of the Carbonate of Lime.—Its Action on Porcelain.—Additional Apparatus required in consequence of that Action.—Good Results; in particular, four Experiments illustrating the Theory of Internal Calcination, and showing the Efficacy of the Carbonic Acid as a Flux.*

Since I found that, with porcelain tubes, I could neither confine the carbonic acid entirely, nor expose the carbonate in them to strong heats, I at last determined to lay them aside, and return to barrels of iron, with which I had formerly obtained some good results, favoured, perhaps, by some accidental circumstances.

On the 12th of February 1803, I began a series of experiments with gun-barrels, resuming my former method of working with the fusible metal, and with lead; but altering the position of the barrel from horizontal to vertical, the breech being placed upwards during the action of heat on the carbonate. This very simple improvement has been productive of advantages no less remarkable than in the case of the tubes of porcelain. In this new position, the included air, quitting the air tube on the fusion of the metal, and rising to the breech, is exposed to the greatest heat of the furnace, and must ther[illegible]re re-act with its greatest force; [illegible], in th[illegible]orizontal position, that air might go as far [illegible] th[illegible] metal reached, where its elasticity [illegible] T[illegible] same disposition enabled me [illegible]rel plunged, during the action [illegible]; which contributed [illegible] e [illegible] d safety of these ex-[illegible]

[illegible] f the brick furnace with the

vertical muffle, already described
pit (*aaa*, fig. 20.) to be excavat
of receiving a water vessel. Th
rately, fig. 21.) was made of ca
in diameter, and three feet deep ;
off from it at right angles, four
communicating with a cup (*ef*)
feet. The main vessel being p
below the vertical muffle, and t
furnace, water poured into the
and could thus conveniently be
(The whole arrangement is re
muzzle of the barrel (*g*) being
its breech (*h*) reaching up into t
convenient, its position was se
The heat communicated down
face of the water (at *c*) in a s
thus occasioned being supplie
which, if necessary, a consta
flow.

As formerly, I rammed the c
lain, and placed it in a cradle o
and a pyrometer ; the cradle b
which rod I now judged prope
rel would admit, in order to e
metal as possible ; for the expa
in proportion to the quantity b
could be reduced, the less ris
barrels.

In the course of practice,
moving the metal and withdr
in placing the barrel with its
keep the breech abov the furn
was exposed to strong heat i
the metal was discharged fron
of the barrel being lowered by
removed in succession, till at
became entirely loose. As th
received in a crucible filled w

of iron placed over the pit, which had been used, during the first stage of the experiment, to contain the water vessel. It was found to be of service, especially where lead was used, to give much more heat to the muzzle than simply what was required to liquefy the metal it contained; for when this was not done, the muzzle growing cold as the breech was heating, some of the metal delivered from the breech was congealed at the muzzle, so as to stop the passage.

According to this method, many experiments were made in gun-barrels, by which some very material steps were gained in the investigation.

On the 24th of February I made an experiment with spar and chalk; the spar being placed nearest to the breech of the barrel, and exposed to the greatest heat, some baked clay intervening between the carbonates. On opening the barrel, a long continued hissing noise was heard. The spar was in a state of entire calcination; the chalk, though crumbling at the outside, was uncommonly hard and firm in the heart. The temperature had risen to 32°.

In this experiment we have the first clear example, in iron barrels, of what I call *internal calcination*; that is to say, where the carbonic acid, separated from the earthy basis, has been accumulated in cavities within the barrel. For, subsequently to the action of strong heat, the barrel had been completely cooled; the air, therefore, introduced by means of the air tube, must have resumed its original bulk, and by itself could have no tendency to rush out; the heat employed to open the barrel being barely sufficient to soften the metal. Since, then, the opening of the barrel was accompanied by the discharge of elastic matter in great abundance, it is evident that this must have proceeded from something superadded to the air originally included, which could be nothing but the carbonic acid of the carbonate. It follows, that the calcination had been, in part at least, internal; the separation of the acid from the earthy matter being complete where the heat was strongest, and only partial where the intensity was less.

The chemical principles stated in a former part of this paper, authorised us to expect a result of this kind. As

heat, by increasing the volatilit
parate it from the earth, we
under the same compression,
one portion of the carbonate m
not: and that the least heated
posed to a change, not only fro
in consequence of the calcinatio
carbonic acid disengaged by
of the two, must have added to
elastic fluid, so as to produce
By this means the calcinatio
might be altogether prevented,
be hindered from making an
reasoning seemed to explain t
had frequently occurred where
age; and it opened some new
riments, of which I availed m
the internal calcination of one
motes the compression of oth
it, I conceived that we might
by placing a small quantity of
in the same barrel with a larg
and by arranging matters so
should undergo a moderate he
pable of producing internal cal
the rest of the carbonate. I
experiments, and obtained re
this reasoning, and which
though the heat did not alway
I intended it to do so.

On the 28th of February
accurately weighed, into a
within a larger one, the rest
with pounded chalk; these c
pieces of chalk, placed along
dle, weighing in all 195·7 g
air rushed out with a long-
contents of the little tube wer
borax which had been intro

exclude the fusible metal. But the rest of the carbonate, contained in the large tube, came out in a fine state, being porous and frothy throughout; sparkling every where with facettes, the angular form of which was distinguishable in some of the cavities by help of a lens: in some parts the substance exhibited the rounding of fusion; in many it was in a high degree transparent. It was yellow towards the lower end, and at the other almost colourless. At the upper end the carbonate seemed to have united with the tube, and at the places of contact to have spread upon it, the union having the appearance of a mutual action. The general mass of carbonate effervesced in acid violently, but the thin stratum immediately contiguous to the tube, feebly, if at all.

On the 3d of March I introduced into a very clean tube of porcelain 36·8 of chalk. The tube was placed in the upper part of the cradle, the remaining space being filled with two pieces of chalk, cut for the purpose; the uppermost of these being excavated, so as to answer the purpose of an air-tube. The pieces thus added were computed to weigh about 300 grains. There was no pyrometer used, but the heat was guessed to be about 30°. After the barrel had stood during a few minutes in its delivering position, the whole lead, with the rod and cradle, were thrown out with a smart report, and with considerable force. The lowermost piece of chalk had scarcely been acted upon by heat. The upper part of the other piece was in a state of marble, with some remarkable facettes. The carbonate in the little tube had shrunk very much during the first action of heat, and had begun to sink upon itself by a further advancement towards liquefaction. The mass was divided into several cylinders, lying confusedly upon each other; this division arising from the manner in which the pounded chalk was rammed into the tube in successive portions. In several places, particularly at the top, the carbonate was very porous, and full of decided air-holes, which could not have been formed but in a soft substance; the globular form and shining surface of all these cavities clearly indicating fusion. The substance was semi-transparent; in some places yellow, and in some colourless. When broken, the solid parts

showed a saline fracture, compos
The carbonate adhered, from en
incorporated with it, so as to re
tain what loss had been sustain
contact was of a brown colour;
suspecting the presence of any f
haps, from the iron rod which
the chalk. But, in subsequent ex
the same brown or black colour
nate with the porcelain tubes,
purposely rammed with a piece
lour, which has occurred in alm
mains to be accounted for. Th
lently with acid; the substance
doing so, however, more feebly
copious deposit of white sandy
part of the tube, taken up by the

On the 24th of March I mad
stout gun-barrel, and took som
of heat, to cool the barrel slowl
tion. The whole mass was fo
touched by the lead; having a
structure, with various facettes
most decided crystallization I
small size: owing to its transp
sible till the light was made
surface, which then produced
the naked eye: when examine
seen to be composed of several
the fracture of the specimen, al
other, and reflect under the
producing the dazzle. This str
well in both parts of the broke
periment, as large a facette w
chalk; but this result was of
been produced from chalk pre

The foregoing experiments
iron vessels over those of porce
was not great; and I persever

experiments with gun-barrels, by which I occasionally obtained very fine results: but I was at last convinced that their thickness was not sufficient to ensure regular and steady success. For this purpose it appeared proper to employ vessels of such strength, as to bear a greater expansive force than was just necessary; since, occasionally (owing to our ignorance of the relation between the various forces of expansion, affinity, tenacity, &c.), much more strain has been given to the vessels than was requisite. In such cases barrels have been destroyed, which, as the results have proved, had acted with sufficient strength during the first stages of the experiments, though they had been unable to resist the subsequent overstrain. Thus my success with gun-barrels depended on the good fortune of having used a force no more than sufficient to constrain the carbonic acid, and enable it to act as a flux on the lime. I therefore determined to have recourse to iron barrels of much greater strength, and tried various modes of construction.

I had some barrels executed by wrapping a thick plate of iron round a mandrel, as is practised in the formation of gun-barrels; and likewise by bringing the two flat sides together, so as to unite them by welding. These attempts, however, failed. I next thought of procuring bars of iron, and of having a cavity bored out of the solid, so as to form a barrel. In this manner I succeeded well. The first barrel I tried in this way was of small bore, only half an inch: its performance was highly satisfactory, and such as to convince me, that the mode now adopted was the best of any that I had tried. Owing to the smallness of the bore, a pyrometer could not be used internally, but was placed upon the breech of the barrel, as it stood in the vertical muffle. In this position it was evidently exposed to a much less heat than the fiducial part of the apparatus, which was always placed, as nearly as could be guessed, at the point of greatest heat.

On the 4th of April an experiment was made in this way with some spar, the pyrometer on the breech giving 33°. The spar came out clean, and free from any contamination,

adhering to the inside of the
much shrunk, still retaining a
bent by partial adhesions. Its s
mains of the impression taken
it into the tube: it had, to the n
semi-transparency of the pith of
skin. By the lens this same sur
all over, though irregularly, sho
air-holes. In fracture it was
treous than crystalline, though
mass was seemingly formed of a
selves quite transparent; and, at
were visible of perfect transpare
produced in the fire; for the s
water, and passed through sieve
of those used at Etruria, as desc
in his paper on the construction

With the same barrel I obtai
giving as strong proofs of fusi
ments; with this remarkable d
the substance was compact, wi
ing. In the gun-barrels whe
there had always been a loss
nected, probably, with the froth
for a reason soon to be stated, t
could not be observed; but app
that here the loss had been sma

On the 6th of April I made
square barrel, whose thickness
successive scales, produced by
small rent began to appear exte
ever, penetrate to the bore. T
meter on the breech of the bar
the metals, the cradle was foun
in the attempts made to withd
widened externally: but it was
not been laid open, for part of
of saline marble; another was

saline grains, and scarcely effervesced in acid. It was probably quicklime, formed by internal calcination, but in a state that has not occurred in any other experiment.

The workman whom I employed to take out the remains of the cradle, had cut off a piece from the breech of the barrel, three or four inches in length. As I was examining the crack which was seen in this piece, I was surprised to see the inside of the barrel lined with a set of transparent and well defined crystals, of small size, yet visible by the naked eye. They lay together in some places, so as to cover the surface of the iron with a transparent coat; in others they were detached, and scattered over the surface. Unfortunately, the quantity of this substance was too small to admit of much chemical examination; but I immediately ascertained that it did not in the least effervesce in acid, nor did it seem to dissolve in it. The crystals were in general transparent and colourless, though a few of them were tinged seemingly with iron. Their form was very well defined, being flat, with oblique angles, and bearing a strong resemblance to the crystals of the lamellated stylbite of Haüy. Though made above two years ago, they still retain their form and transparency unchanged. Whatever this substance may be, its appearance, in this experiment, is in the highest degree interesting, as it seems to afford an example of the mode in which Dr. Hutton supposes many internal cavities to have been lined, by the sublimation of substances in a state of vapour, or held in solution by matters in a gaseous form. For, as the crystals adhered to a part of the barrel, which must have been occupied by air during the action of heat, it seems next to certain that they were produced by sublimation.

The very powerful effects produced by this last barrel, the size of which (reduced, indeed, by repeated oxidation) was not above an inch square, made me very anxious to obtain barrels of the same substance, which, being made of greater size, ought to afford results of extreme interest. I found, upon inquiry, that this barrel was not made of Swedish iron, as I at first supposed, but of what is known by the name of *old sable*, from the figure of a sable stamped upon the bars;

that being the armorial badge o
this iron is made *.

A workman explained to m
different kinds of irons, most in
suit; and he illustrated what I
iron, when exposed to a certain
under the hammer; but the ten
pens, varies with every different
me, cast iron crushes in a dul
15° of Wedgewood; steel in a
dish iron, in a bright white
old sable itself likewise yields,
perhaps of 100°. I merely gue
but I am certain of this, that
which Swedish iron crumbled
sable withstood a strong blow,
siderable firmness. It is from
that the blacksmith, when he
forge, and lays it on the anvil,
till the temperature has sunk to
can bear the hammer. I obser
forge acted on the Swedish iro
surface, clearly indicating the
matter; whereas, the old sable
acquired the shining surface
without any effervescence. I
siderable number of bars of th
my expectations.

By the experiments last
point was gained in this inv
bility of the carbonate under
blished. But from this very
of adding some new devices t
the carbonate, in fusion, spre
tube containing it, and the t
as to be quite inseparable, it
periment, to ascertain the w

---

* I was favoured with this account

method previously used. I therefore determined in future to adopt the following arrangement.

A small tube of porcelain (*i k*, fig. 23.) was weighed by means of a counterpoise of sand, or granulated tin; then the carbonate was firmly rammed into the tube, and the whole weighed again: thus the weight of the carbonate, previous to the experiment, was ascertained. After the experiment, the tube, with its contents, was again weighed; and the variation of weight obtained, independently of any mutual action that had taken place between the tube and the carbonate. The balance which I used, turned, in a constant and steady manner, with one hundredth of a grain. When pounded chalk was rammed into this tube, I generally left part of it free, and in that space laid a small piece of lump chalk (*i*), dressed to a cylinder, with the ends cut flat and smooth; and I usually cut a letter on each end, the more effectually to observe the effects produced by heat upon the chalk; the weight of this piece of chalk being always estimated along with that of the powder contained in the tube. In some experiments I placed a cover of porcelain on the muzzle of the little tube, (this cover being weighed along with it,) in order to provide against the case of ebullition: but as that did not often occur, I seldom took the trouble of this last precaution.

It was now of consequence to protect the tube, thus prepared, from being touched during the experiment by any substance, above all by the carbonate of lime, which might adhere to it, and thus confound the appreciation by weight. This was provided for as follows: The small tube (fig. 23. *i k*), with its pounded carbonate (*k*), and its cylinder of lump chalk (*i*), was dropt into a large tube of porcelain (*p k*, fig. 24). Upon this a fragment of porcelain (*l*), of such a size as not to fall in between the tubes, was laid. Then a cylinder of chalk (*m*) was dressed, so as nearly to fit and fill up the inside of the large tube, one end of it being rudely cut into the form of a cone. This mass being then introduced, with its cylindrical end downwards, was made to press upon the fragment of porcelain (*l*). I then dropped into the space (*n*), between the conical part of this mass

and the tube, a set of fragn
what could possibly fall bet
tube, and pressed them dow
chalk being at the same tim
angle, was forced into a mas
ally prevented any thing fron
of chalk and the tube. In pr
always to answer, when don
thus rammed, with a stratu
again with pounded chalk (*p*
I filled the whole of the large
and chalk ; the muzzle bei
which was easily pressed in
and, suffering no change i
fusible metal in the first sta

The large tube, thus fill
sometimes with the muzzl
reverse. I have frequently
of the arrangement, each n
tages and disadvantages.
shown in fig. 24. and 25.) th
the intrusion of the fusible
the air-tube in the workin
part of the barrel ; and the
(at *q*, fig. 25.) below the m
communication is cut off b
inside of the tube. On th
ment, the small tube, whicl
paratus, is placed at a consi
of the barrel, so as either to
part, or to render it necessa
into the muffle.

With the muzzle of the l
tube is placed (as shown in
muzzle upwards, and in c
large tube. This has the
tube near to the breech of
here less security against t
have found that a point of

the experiment is a good one, and that the carbonic acid has been well confined, the intrusion seldom takes place in any position. In whichever of the two opposite positions the large tube was placed, a pyrometer was always introduced, so as to lie as near as possible to the small tube. Thus, in the first-mentioned position, the pyrometer was placed immediately below the large tube, and, in the other position, above it; so that, in both cases, it was separated from the carbonate by the thickness only of the two tubes.

Much room was unavoidably occupied by this method, which necessarily obliged me to use small quantities of carbonate; the subject of experiment seldom weighing more than 10 or 12 grains, and in others far less *.

On the 11th of April 1803, with a barrel of old sable iron, having a bore of 0·75 of an inch, I made an experiment in which all these arrangements were put in practice. The large tube contained two small ones; one filled with spar, and the other with chalk. I conceived that the heat had risen to 33°, or somewhat higher. On melting the metals, the cradle was thrown out with considerable violence. The pyrometer, which, in this experiment, had been placed within the barrel, to my astonishment indicated 64°. Yet all was sound. The two little tubes came out quite clean and uncontaminated. The spar had lost 17·0 per cent.: the chalk 10·7 per cent. The spar was half sunk down, and run against the side of the little tube: its surface was shining, its texture spongy, and it was composed of a transparent and jelly-like substance: the chalk was entirely in a state of froth. This experiment extends our power of action, by showing, that compression, to a considerable degree, can be carried on in so great a heat as 64°. It seems likewise to prove, that in some of the late experiments with

---

* I measured the capacity of the air-tubes by means of granulated tin, acting as a fine and equal sand. By comparing the weight of this tin with an equal bulk of water, I found that a cubic inch of it weighed 1330·6 grains, and that each grain of it corresponded to 0·00075 of a cubic inch. From these data I was able, with tolerable accuracy, to gauge a tube by weighing the tin required to fill it.

which had separated its acid
the carbonate, according to th
soundness of the barrel was p
those carbonates which lay in
tube in this experiment had a
third of a cubic inch.

The second of these exper
of April, in the same barrel
forded some good results. Th
third of its former bulk, that is
The heat rose to 60°. The
with a black spongy substan
failure; and a small drop of
ance. The cradle was remov
hissing. The carbonates were
had yielded, but had resisted
of the little tube were found
and running with the porcelai

The third experiment was
another similar barrel. Every
as in the two last experiment
now reduced to half its last b
of a cubic inch. A pyromete
large tube. The uppermost
The contents of the inner t
were reduced to a most be
much injured by the interna
thinner state of fusion than h

The fourth experiment wa
the rest in all respects, wi
0·0318, being less than one
upper pyrometer gave 25°,
lowest masses of carbonate
heat: the contents of the l
both the lump and the pou
state, and in several places
inside of the tube, which I
a low heat. On the upper

the little tube, which after its introduction had been wiped smooth, were a set of white crystals, with shining facettes, large enough to be distinguished by the naked eye, and seeming to rise out of the mass of carbonate. I likewise observed that the solid mass on which these crystals stood was uncommonly transparent.

In these four experiments the bulk of the included air was successively diminished, and by that means its elasticity increased. The consequence was, that in the first experiment, where that elasticity was the least, the carbonic acid was allowed to separate from the lime, in an early stage of the rising heat, lower than the fusing point of the carbonate, and complete internal calcination was effected. In the second experiment, the elastic force being much greater, calcination was prevented, till the heat rose so high as to occasion the entire fusion of the carbonate, and its action on the tube, before the carbonic acid was set at liberty by the failure of the barrel. In the third experiment, with still greater elastic force, the carbonate was partly constrained, and its fusion accomplished, in a heat between 41° and 15°. In the last experiment, where the force was strongest of all, the carbonate was almost completely protected from decomposition by heat, in consequence of which it crystallized and acted on the tube in a temperature between 25° and 16°. On the other hand, the efficacy of the carbonic acid as a flux on the lime, and in enabling the carbonate to act as a flux on other bodies, was clearly evinced; since the first experiment proved, that quicklime, by itself, could neither be melted, nor act upon porcelain, even in the violent heat of 79°; whereas, in the last experiment, where the carbonic acid was retained, both of these effects took place in a very low temperature.

[To be continued.]

LVI. *Observations and Advi*
compatible with the quickest
Sugar, and conducive to the
Bryan Higgins, *M. D.**

Sound cane-juice consists o
sweet, herbaceous matter, carb
and some juices contain varia
dients, which are not yet to be

In these pharmaceutic ingr
or chemical principles of many
rience shows, that the compos
sulting from such proportions
in the recent juice, tend chiefl
similar to vinegar, and of an a
acid and melasses acid.

For in the course of 12 or
the rise and escape of carbonic
an earlier period it smells sour
of such delay on the sugar pr
that there is an addition to th
lasses acid.

This last is the ingredient w
the crystallization and separa
from the deliquescent sweet
lasses. As it lessens the quan
increases that of melasses mot
probable that melasses contair
principle, I give it the tempo

Herbaceous matter is that o
in the yawing, and more in t
been cleared from gross filth
we endeavour to separate fro
ing and skimming.

The herbaceous matter ha
sins, but has a much neare
racter, to the dregs of refined

---

* From Part I. of Dr. Higgins's O

stance which constitutes the chief difference between the finest and the basest indigo.

The herbaceous matter of cane-juice, like that of indigo, varies with the constitution of the plant in different soils and seasons, and especially in respect to its solubility; insomuch that some juices hold about $\frac{1}{300}$dth part of it in strict solution after boiling, while others hold not 1000dth.

But as herbaceous matter is rendered more soluble by the intervention of carbonic acid, any cane-juice holds more herbaceous matter in solution before it has been heated, than it can retain at the temperature of yawing or boiling.

For in the augmented temperature the carbonic acid forsakes the herbaceous matter to combine with that which makes the acid aëriform; the minute gaseous bubbles in their escape agitate and impel the particles lately thrown out of solution, until in their coalescence they become not only visible but large. We may express this change in the clear recent juice by the agency of fire alone, as the workmen do, by saying the liquor breaks.

Fresh cane-juice begins to break when the heat approaches to 140 degrees of Fahrenheit; and the herbaceous matter, which has felt no greater heat, has an olive green colour.

Whether this be exposed to greater heat, or we advert to that which is thrown out during the subsequent reduction of the juice to sugar, the herbaceous matter is found to change colour with the increase of temperature, through gradations of yellow, olive, and brown, increasing in intensity and darkness until the matter is charred to blackness. As it changes in colour it becomes less soluble. The carbonic acid continues to escape, and the extricated herbaceous matter accumulates to the surface, while the liquor is heated to 195°.

Now the watery vapour arising with the carbonic acid bubbles, pushes the cleansed liquor frothing white through intervals in the swollen scum. This, which is called *yawing*, shows that a greater heat would cause a boiling commotion: but if some time be allowed for the residuary carbonic acid to escape, the liquor will not boil until this heat amounts to 206°, or within five degrees of the heat of boiling water.

The aëriform bubbles entan
render it more buoyant than it
able it to carry with it, and to
accidental filth of the liquor :
is by its own nature sufficientl
the skimmer, or by drawing aw
beneath it.

But, if the buoying bubbles
and the commotion of boiling,
the liquor.

The skimmer will now avail
matter, once thrown out of s
filth, in an hour, in a coolin
leave it transparent, although
herbaceous matter, which the
portions of carbonic acid, can

But as this depuration by
without injury to the juice, t
moved before the liquor boils.

In consequence of this lin
herbaceous matter becomes e
tity proportionate to that of t
pelled by evaporation, and th
bid by the extricated herbacec

However often the process
the liquor is depurated to p
dence or otherwise, it will
deposition of herbaceous dr
renewed ; and it will thus yi
the residuary liquor becomes
to be incapable of holding th
in solution.

All this takes place whe
be used or not. But the cle
when temper is used.

To ascertain the true use
agency on herbaceous matt
acid.

Lime powerfully attracts

lime be a soluble body, and although it meet the acids in the aëriform state, it forms with it quickly an insoluble body similar to whiting or chalk.

Lime also combines with a triple or quadruple quantity of herbaceous matter to form a compound less soluble than the latter in water; and in cane-juice, lime meeting carbonic acid and herbaceous matter, unites with both to form a triple compound. For if the lime used in clarifiers were to unite with the carbonic acid only, we should find bottoms consisting of whiting, which I have looked for, but could never obtain.

It is by virtue of these relations that a small quantity of lime, or transparent lime water in which the lime can be only $\frac{1}{500}$th part of the whole, when added to cane-juice that has been duly cleared, renders it presently turbid with herbaceous matter now extricated, and thus facilitates the abstraction of this matter by subsidence. Thus, also, cane-juice which is a little wheyey or clouded is broken to flocculence by transparent lime water as well as by lime.

I say the liquor is broken to flocculence when the particles of herbaceous matter, seized by those of the lime, and coalescing, appear large and flocculent; and the liquor interceding them is seen quite transparent when viewed by transmitted light in the narrow part of a wine-glass.

This breaking may also be distinguished in a bright silver spoonful of the liquor by reflected light.

On these grounds some lime ought to be added to cane-juice which contains the ordinary quantity of herbaceous matter, not with the vain hope of separating all the herbaceous matter at once, but with the experienced certainty that the liquor yawed or cleansed with the aid of lime, will contain less herbaceous matter in solution than it would otherwise have retained, and will require the less additional lime to act on the melasses acid.

Towards the kind of depuration which can be effected in the process of yawing, lime thus contributes something, but not nearly so much as has been generally supposed: for a quantity of lime which is sufficient to give a nauseous taste to the sugar, is yet incompetent to the extrication of all the herbaceous matter, so that it shall be separable by yawing or subsidence: and an excess of lime, not greater than $\frac{1}{4000}$dth or $\frac{1}{3000}$dth of the weight of the juice, is constantly attended with a manifest debasement of the colour of the sugar, when this excess takes place in the beginning of the boiling, or previous to the reduction of the juice by evaporation. It is of no practical use to inquire after every agency by which the excess of lime has these effects; but it is expedient to observe, that when a juice is yawed with excess of lime, and cleared to transparency by subsidence, which soon takes place in a specimen quickly cooled in a wine-glass, it will show colour approaching to that of porter; while the like juice, treated in the same way, but with only a moderate dose of temper, will be almost colourless when transparent.

It is moreover to be observed in ordinary practice, that when too much temper has been used in the yawing, the liquor, during the boiling of the teaches, looks much browner than that which has been less tempered. The scum has a darker colour, and is more apt to break and sink into the liquor; and it has less of the tenacity and flocculence by which ordinary scum clings on the skimming instrument, and is separable by the common process.

The practical inference from all these facts is, that the temper ought to be used sparingly in the raw juice in the operation of yawing, although it should be found necessary to use more temper afterwards, for purposes different from those lately recited.

It is chiefly by reason of the agency of the temper on the melasses acid, or on that matter which most powerfully impedes the separation of the sugar from the melasses mother-liquor, that the temper is eminently useful in the manufacture of Muscovado sugar, and that greater quantities of it may be advantageously employed, provided the whole of it be not administered at once, and at the period of the manufacture in which it is apt to colour the juice, to lessen the buoyancy and tenacity of the scum, and to frustrate the labour of the skimmer. Among the signs which may guide an intelligent sugar-boiler in respect to the doses of temper, those which correspond with the foregoing observations are the simplest and most certain.

When the artist knows that the quantity useful in yawing is less than is necessary for a bold grain and speedy curing of the sugar, and is apprised of the practicability of abstracting all the temper that may be used afterwards in the teaches, he will not err by excess of temper in the first process.

Supposing that he tempers in a grand boiler, or uses a clarifier to the same effect, he will introduce a quantity of temper rather too small than too great, when the vessel has received three-fourths of its charge. He will yaw and check the fire and skim, and then boil moderately and skim for eight or ten minutes. He will then take a wine-glass full of the liquor, and if, after cooling a little, it looks wheyey and not broken, he will use one-sixth or one-fourth of the first quantity of lime, and will immediately take a fresh sample. When the liquor appears broken, and clears with little or no colour, he has hit the precise quantity which is compatible with the cleanness and whiteness of the sugar, and which goes nearest to the whole quantity to be used for the perfection of the grain.

By the usual ladle-proof he will soon ascertain the additional quantity of temper to be used in the inspissated liquor, in the manner presently to be described.

He that will not follow this rule may take a grosser, by using three-fourths of the temper in the yawing, and the remainder in the inspissated liquor.

It has not been unusual for the boilers to put temper in the second and first teach, when the proof by the ladle showed that the temper used in yawing was not sufficient for the granulation of the sugar. Such temper there used was the least injurious to the colour of the sugar; but as none of it could now be separated by skimming from the thick syrup, it manifestly adulterated the sugar, and increased the quantity of filth to be seen in a solution of it.

But no such objection lies against the free use of temper in the syrup, provided we can extract all this temper and all the filth which it catches, and advance the syrup transparent

and clear, to yield sugar emulati
coarse lump sugar, for general us
described celerity in the transit
sugar. For, in a just compariso
nomically, we are to advert, n
whiteness, which may be varied
chiefly to the cleanness of equal
ing effects of portions equal in d

The common use of yellow su
of Europe especially, shows tha
Muscovado sugar which has im
in the crude state. It is truly t
solution of it, which has forbi
and depreciated it so far below l
sequence of the cleaning by filtr
of the blanching by breaking th
the lump sugar has such prefere

It is this filth, also, which
Europe to use ox blood in quan
purity of the Muscovado sugar ;
and waste attending the abstra
abundant scum, consisting of th
tangled in the filaments of co
chief cause of his inability to gi
sugar, nearer to that at which
sugar.

Of the Improveme

It will therefore be the first c
and it will be the most desirabl
that it be made clean by the me
tion, which are employed in t
lump sugar; and, until this ch
nothing ought to be said conce
expedients which may be adva
circumstances.

As the true meaning of the
stood by all, and doubts and c
the mere abuse or misconcep
dient that it should be defined i

workmen, to whom these pages may ultimately be communicated.

When a foul liquor is passed through a fine wire sieve, or through a blanket, which stops the coarse filth, but not the finer, and where the liquor so treated still remains clouded or turbid, this is called *straining:* but when a medium, such as close cloth or unsized paper, is used, and this stops all extricated filth and passes the liquor transparent, the process is called *filtration.*

In the refineries in Europe a blanket serves as a filter, but not before the filth of the solution of Muscovado sugar has been entangled in flocks of coagulated ox blood, too large to pass through the interstices of a blanket.

The use of such a woollen strainer has been tried in this island, but is generally abandoned for good reasons.

A blanket only strains the boiled cane-juice, while it passes with the velocity necessary for the manufacture of good Muscovado sugar. When the interstices of the blanket are narrowed by coarse flocculent filth, and when it begins to filtrate truly, the process becomes so slow as to retard the manufacture intolerably: the last portions refuse to pass through; the quantity of sweets retained in and on a large thick blanket makes a great defalcation from the sugar, and the cleansing of the cloth is laborious.

To make the process of filtration applicable in the manufacture of Muscovado sugar, it was necessary that a medium should be employed capable of filtrating truly at the beginning. It was equally necessary that the velocity of this filtration should be equal to that with which the liquor would pass turbid through a coarse strainer of the same dimensions. It was moreover requisite, for the reasons above mentioned, that this rapid filtration should be confined to that period in which all the herbaceous matter is thrown out of solution, and in which the liquor is viscid with sugar.

These desiderata are attained in the invention lately presented under trial to as many of the honourable members of the appointed committees as could be assembled at the time and place.

In this first mechanism the proof of the principles and

powers was chiefly attended to
are now to be made, the utmo
tained; and from these only th
which I shall soon lay before th
to be made.

At the present moment I mus
senting a few lines descriptive o
a small simple filtrating instrun
tended uses.

In ordinary cases, the power by
through the interstices of a fil
weight of the liquor; and, unde
the velocity of filtration is as th
But, as in ordinary vessels used f
on a given area of the filtratin
height of the liquor above it, o
may affirm generally, that the
number of square inches of filtra
height of the contained pressing
attain any required velocity of
pressing column may be made
sirable reduction of the size of t

Supposing, for instance, a c
or 60 square feet in area, coul
charge of liquor measuring 3 i
this cloth, or 10 square feet of i
or charge of liquor pressing on
in height: and with the heigh
would serve; and this is less th
pocket handkerchief.

By the like reasoning it will
60 square feet filter no quicker t
gress of the manufacture, the
as the liquor lowers to a smal
and still slower as the height
creases; so that at the height o
trated in a given time would be
that which the progress of the

But when it is considered

much until the liquor is rich and viscid with sugar; that every filtration abates as the interstices of the cloth become narrowed, or clogged with filth; and that a rich saccharine liquor expanded on a large cloth in a basket, in the usual mode of filtration, will soon be chilled, and incapable of passing through the chilled and agglutinated filth; it will readily appear that the quantity of sweets retained in and upon the cloth would cause an enormous defalcation of the sugar, and great labour in washing out the sweets for the stillhouse, and the filth from any great filter. We are to revert, then, to the small filter above mentioned, acting by the pressure of a high column of liquor, in order to obviate the described inconveniences.

It may appear paradoxical at the first view, but it is a fact demonstrated in every school-book of natural philosophy, that the pressure of the liquor on the filter is the same whether the superincumbent column consists of a ton or of a pint of the liquor, provided the heights of these columns be equal.

Therefore, instead of making an instrument to give a ton of pressure, by containing about a ton, or 250 gallons of liquor, I have given an equivalent pressure by a pint or two contained in a slender perpendicular tube: and instead of setting the filtrating bag to a great capacity, I have set it vertical, flat, and with the opposite parallel sides so near to each other, as to leave room only for the filth to be collected from half a ton or a ton of sugar.

By such mechanism and pressure the juice may be filtrated truly and expeditiously, even when it is so rich and viscid with sugar that it could not pass through any filtrating medium used in the ordinary way. The filtration keeps pace with the ladling forward, when the cloth measures about 10 or 12 feet square, and the flattened bag about 5 square feet: and the same bag will clean from 10 to 15 or 20 hundred weight of sugar, according to the nature of the juice and the care of the workman in the previous depurations by yawing and skimming.

By these means, also, the whole quantity of liquor in the filter at any time may fall short of a gallon; and the quantity

tity retained when the bag bec
filth is too inconsiderable to de
ings were not to go to the st
pressure of the slender column
made competent to squeeze th
that of one, two, or three tons
consistency of dough, if that w

The cloth which answers for
and durability, and cheapness
double swanskin: it is sewed
placed flat between two reeded
mouth of the bag is perfectly
or fell to be compressed by th
supplied from the slender pres
cock entering a small short tu
the bag: by drawing a little of
ligature becomes closer as the
greater.

It is easy to conceive how
slung into its place or removed
for another that is already was

To prevent fruitless experim
sary to observe, that in any p
tical now described, the bag w
only strain the liquor, and tha
tical, the filtration will be slow

When liquor is to be thrown
course of business, to be ladle
the instrument, by the gutter,
quickly into the first teach.

When the ladle is held in t
throwing the liquor to the des
derable: but it becomes unc
of a slender pendulous chain
handle of the ladle at a spur
motion, or the fulcrum on w
little effort to the workman.

At skipping-time the inst
syrup to recruit the emptied

few minutes: if it were as many hours, such syrup would take no damage in the time.

About twelve ladlings forward belong to a skip; and for each of these its share of reserved temper is to be used. Less than a tea-spoonful generally serves: a small excess does no harm now to the colour of the sugar: both the filth and the temper are stopped in the filter; and the sugar becomes improved in the manner above described, provided no part of it be over-heated in the skipping.

The damage which the liquid sugar takes here is certainly greater, as it is fouler by the herbaceous matter; because the herbaceous matter becomes darkened or charred sooner than the mere sugar. But whether the filter be used or not, there will always be some depravation of the colour of the ground sugar when the skipping is conducted in the usual manner.

Of the Spraying Instrument in Skipping.

It is now sufficiently understood, that in boiling down and in ladling forward, great care ought to be taken that no part of a vessel, between the surface of the charge and the under-pinning, shall be so far heated as to burn-to the syrup or sugar adhering to it; and that this burning or charring is to be prevented by one negro rolling the residuary liquor up to the under-pinning, until another has ladled forward and charged the evacuated teach, and until the liquor froths to the under-pinning.

But as nothing of this kind is practicable in the skipping from the first teach, some new expedient is necessary to prevent the burning-to which is manifested in every whole skip, by the hissing heat of the copper, by the empyreumatic smell, and by the film of charred matter which washes from the sides into the subsequent charge of liquor; for the practice of some, in skipping only one-half of the ready and graining charge, is a very objectionable shift.

To preserve the crop and grain once attained, to prevent all empyreuma, and to maintain every advantage of the filtration, I have contrived, and presented in trial to the ho-

nourable gentlemen of the cor
which the negroes have since

It is nothing more than a
copper, about six feet and a h
one-half or three-fourths of a
a spray of water on the botto
teach during the short time of
ficiently and equally with a ver

Upon the common shed or
the stoker, a cask of water is
leathern tube inserted in the c
of water into the metallic tub
and the other end of the met
six small holes, like those in t
looking upwards when the tub
is squirted in the form of spra
high column to the extent of
teach only, and the spray ceas

The direction of the spray
for a spur on the tinned iro
place; and he has only to ho
while he grasps it near the spu
the fire-place with one hand
with the other.

The fire is not disturbed, a
chill the furnace and clot upo
porates as it touches and co
face of the furnace remains u
charge boils in the first teach
is stopped, and the instrumen
drawn.

The advantage of this in
prevention of empyreuma an
all the portions of the skipp
as the workmen say, equall
man to defer the skipping
sive; and these purposes ar
of two or three quarts of wa

Subservience of these Measures to the Improvement of Rum.

Concerning rum it is now to be observed, that it derives the depreciating characters of the recent spirit from two sources; the chief of which is the filth of the scums, and especially the first scums in yawing.

The tendency of such matter, even if there were nothing verminous or animalcular in it, is to the putrefactive fermentation, or rotting, while that of the sweet is to the vinous fermentation, and thence to the acetous; the product of the former fermentation is as offensive to the smell and taste, and as noxious, as that of the latter is grateful and cordial. Wherever scums are detained to await the spontaneous separation of the sweets from the filth, an intestine motion may be observed, and then chiefly in the concurrence of these fermentations the offensive product is generated; the rest is formed in the fermenting vats, in quantity proportionate to the filth of this kind which passes into them.

Every vinous liquor capable of yielding an intoxicating spirit by distillation, affords some quantity of peculiar essential oil, which awaits the arise of the water of the latter and weaker runnings, and characterizes them; therefore this essential oil is, in a great measure, separable from the spirit by redistillation; especially if salts retentive of the water, and restraining the volatility of the oil, are used.

But it is peculiar to the ordinary manufacture of rum that very offensive ethereal fluid is generated in these mixed fermentations, and that by reason of its volatility it is inseparable by a redistillation.

But from the source above mentioned the essential oil of rum acquires extraordinary nauseousness; and as a single redistillation cannot exclude it totally, and as any number could not exclude the ethereal taint above mentioned, the best new rum of any estate is that which runs intermediate in respect of the offensive ether and the fetid oily feints.

All rum is improved by time in wooden casks, by exhalation of ether and absorption of oil, and under a growing charge for waste and for interest on the price. Some have improved it sooner by ventilation, but not without a great

waste of spirits; but now it
immediately by measures wh
mination; and the first of tl
putrefactive matter by filtrat
veyance of the clear warm t
cistern, there to undergo th
fermentation, and to suffer th
foul scum and bottoms, whicl

Another source of the co
reuma; but as this regards th
rors in making sugar, it is u
present than that the prescri
judicious setting and manage
prevent the empyreumatic sm

LVII. *Letter of M.* Tardy
Pictet, *of Geneva, upon*
dle, *relative to the Densit*

SIR,

THE experiments of Mr. B
order to determine the densit
tracted my attention, I cann
rious objections to which the
are liable. In communicatin
suaded that I shall enter con
have equally for their objects
removal of error.

Mr. Biddle, after having
he followed and the precau
that a thousand grains of r
degree below the zero of
experienced, when weighed
rature, a loss in weight of

A thousand grains of p

---

* From *Bibliothequ*

† *Vide* Nicholson's

balance, in the same alcohol, and at the same temperature, lost 88·105 grains of their weight. Upon this, Mr. Biddle, regarding the loss of weight of the mercury and silver as in an inverse ratio to the specific weights of these metallic substances, and having found that that of silver, with the same balance and in distilled water, was 10·436, he multiplied this sum by 88·105, and divided the product by 59·8, which gave him 15·612 for the specific weight of the mercury in a solid state.

But the same hydrostatic balance having given the number 13·545 for the specific gravity of the same mercury in the liquid state, the thermometer being at + 47° Fahr. (+ 6¼° Reau.), it would seem that nothing remains but to conclude with the author, "*that the volume of solid mercury is less by about one-seventh of what it is in the liquid state.*"

But are all the principles of these calculations faultless? Are none of these weights evidently wrong? I shall not make a gratuitous supposition; I shall judge by facts alone.

The antient tables of specific gravities give 0·806 for that of alcohol or rectified spirit of wine. It is at about 0·820, in the temperature of 19° of Reaumur (+ 54¼° Fahr.), according to M. Bories, of Marseilles, at which the operations on these substances can be regarded as decisive authority. We then fairly value it 0·810, without encroaching much upon truth. But the liquid mercury, which, according to its specific gravity of 13·545, loses in distilled water 73·828 grains in the thousand, ought to lose 59·8 in alcohol at the weight of 0·810; and in this manner the great difference disappears which Mr. Biddle thought himself entitled to mark between the density of liquid and solid mercury.

Pure silver, which in consequence of a specific gravity of 10·436 ought to lose in distilled water 95·822 grains in the 1000, would lose no more than 77·615 in alcohol at 0·810, which is very different from 88·105. To account for this difference, we cannot allege the greater density of the alcohol at the temperature of — 47° Fahr., because that could not contribute *more than two or three grains at most* to the loss of the weight of the silver: we should not be better founded in supposing that the alcohol employed happening to be of an inferior quality, its because upon this supposition, of weight in the silver amoun cific gravity of this alcohol, c must have been 0·920. But I mistaken with such a liquor, w the most common spirits, and could not support the temperatu freezing.

It appears, therefore, ascertai the weights; and consequently density of the solid mercury ha comparison of the results of t been found so much the greate silver had been expressed by to

I have no intention to pre- the density of solid mercury: doubts upon the talents of Mr. tion of the members of the Phil ham, in whose presence and periments of the former were titled to say, that the experim the results, ought at least to b dle's idea is a happy one, and periments may lead to the sol

I hav

LVIII. *Analysis of the sulph*
Naygag. By .

M. Klaproth, having m of manganese under the na vered that it is composed of at the minimum, or solubl of carbonic acid, and of el having discovered either gold or silver in it, as asserted by M. Muller, of Reichenstein.

---

* From *Annales du Muséu*

The celebrated Berlin chemist having thus enriched mineralogy with a new species of the manganese genus, which down to the present time had existed only in one form, that of oxidated manganese, he has also thereby enriched chemistry with a new fact concerning the action of the nitric acid upon sulphurets, for the decomposition of which it is usually employed, with the view of dissolving the metallic oxide combined with sulphur, without touching the latter.

As soon as M. Haüy recognized this mineral in his collection, he sent us a specimen in order that we might submit it to analysis.

M. Proust also analysed this mineral almost at the same moment with M. Klaproth. The former observed the same phænomena, but for want of a large enough quantity he was not able to determine the state in which manganese is when combined with sulphur, nor the respective quantities of these bodies.

The sulphuret of manganese of naygag is accompanied with manganeseous carbonated lime: it has for a matrix a white hyaline quartz: its specific gravity is 4: its texture is lamellous, with a metallic lustre, when the surface has not been long exposed to the air. Reduced into powder, it is of an olive green colour: it loses nothing by heat.

Five grammes of this mineral, perfectly freed from its matrix, were reduced to a very fine powder and treated with weak nitric acid; which immediately exercised a lively action upon it, accompanied with a disengagement of sulphuretted hydrogen gas. We gathered a certain quantity of this gas, in order to examine its nature. The mixture was slightly heated, and a new portion of the nitric acid was introduced until effervescence ceased: the liquor was then filtered, which was a little reddish, but became colourless upon the addition of water. The residue weighed a decigramme. It was composed of blackish brown flakes, which, upon being exposed to flame with the blowpipe, took fire like sulphur, spread a slight arsenical smell, and left a substance which did not colour borax like manganese, but like iron.

The gas obtained in this exper
lime water, did not injure its t
property of blackening solutions

The nitric solution was mixe
it formed an abundant white pr
gagement of carbonic acid gas
order to drive off the excess of
the precipitate, which, upon be
weighed 7½ grammes. The dif
and those of M. Klaproth seen
nese used by us having been ver
by M. Klaproth probably contai

M. Klaproth endeavoured to
sulphur and the oxide of man
order to make comparative exp
that the artificial sulphuret of n
sulphuretted hydrogen could en
racters as the natural sulphuret,
periments, I calcined in a retort
municated with a balloon filled
of carbonate of manganese obtai
of carbonate of potash.

The carbonic acid gas began
retort was red, and at the end
cination the disengagement cea
the retort was slightly coloured
introduced into the retort, whi
flowers of sulphur, and we agit
mixture; the mass melted, an
sulphur was sublimed. As so
sulphur ceased, the mass, whe
warm, took fire on exposure
pyrophorus. It was green,
powder; and it weighed 5·9
phuret dissolved in weak ni
and a disengagement of sulp
leaves more sulphur as a resid

The following is the man
plains the disengagement of

place during the solution of manganese in the nitric acid. In spite of the disengagement, says he, of a considerable enough quantity of sulphuretted hydrogen gas during the solution of this mineral, it appears to me that it would be an error to believe that this gas exists ready formed in the mineral or in any of those which yield it by the humid way, and to regard it as one of their constituent parts. There is no doubt that it is formed by the decomposition of water, since by calcination we obtain nothing else but carbonic acid gas. By synthesis, the probability that no hydrogen enters into the combination of sulphur with the oxide of manganese acquires still more force; and yet this combination yields sulphuretted hydrogen gas with the acids.

In order to know if the nitric acid is not decomposed during the solution of sulphuret of manganese, as happens with almost all the metals which have a great affinity for oxygen, or, if water alone, by yielding its oxygen to one of the elements of this mineral, does not give birth to this hydrogen gas, we dissolved a certain quantity of sulphuretted manganese in weak nitric acid; we concentrated the solution, and distilled it in a retort with caustic potash: but the produce not having given any sign of the presence of ammonia, we concluded from this that the nitric acid is not decomposed in this operation. In order to have the just quantity of oxide of manganese at the minimum, we calcined in a retort 7·4 grammes of carbonate of this metal prepared from a solution of five grammes, and we obtained an oxide almost white, which, weighed while warm, yielded 4·25 grammes, which was at the rate of 85 in the hundred.

Let us actually admit a loss of two parts: we shall then have 13 parts of sulphur; and as the loss can scarcely be any thing else than sulphur, the quantities will stand thus:

Manganese at the minimum -	85
Sulphur - - - - -	15
	100[*]

---

[*] There is also in this mineral a small quantity of iron and arsenic, which has been discovered among the sulphur which remains after its solution in weak nitric acid; but these substances appear to be accidental.

Re

M. Klaproth justly rega
of which we are speaking
he has recourse at the sa
water in order to explain th
hydrogen gas which takes
mineral in the acids; but
how or wherefore water i
The manganese cannot be
united to oxygen, and bec
which have dissolved it in t
in the fossil, that is to sa
then, could not have been
But how can we comprehen
is present? If, however, it
the water, and which gives
gen, I should have found su
of the mineral. In order
cold a certain quantity of
in weak nitric acid, in orde
phur. The phænomena w
filtered solution gave, in f
barytes, a precipitate which

This experiment, then, s
phur united to oxide of ma
posing water by combining
its hydrogen at liberty, whi
of sulphur. This fact is th
of chemists, that, to my
that it has been observed,
tallic sulphurets or sulphu
posed by the strong or weak
the latter which has been
modifications of it, constan
retted hydrogen gas: this i
of chemical affinity. It is
decompose water at the s
hydrogen never makes its
azote of the nitric acid and

The sulphuretted oxide of manganese thus forms an exception to the rule hitherto observed, if we do not admit hydrogen into this substance as one of its constituent parts.

LIX. *Memoir on the Eremophilus and Astroblepus, two new Genera of the Order of Apodes.* By M. DE HUMBOLDT *.

WHEN we ascend the chain of the Andes to the height of 2600 toises (16661⅓ English feet) and upwards, great level plains and lakes of a considerable extent are seen. It is singular to observe, that, while the soil is still covered with a beautiful vegetation, the woods filled with quadrupeds, and the air with a great variety of birds, the water alone, the lakes and the rivers, are so little inhabited. The cause of this phænomenon relates, without doubt, to geological facts; it pertains to the grand mystery of the origin and migration of species.

The considerable lakes which surround the city of Mexico, at the height of 1160 toises †, nourish but two species of fish, of which one, the *axalotl,* belongs rather to the genera *sirenus* and *proteus.* M. Cuvier, to whom we brought this extraordinarily organized animal, unknown in Europe, is engaged with its anatomy, which he will shortly publish. In the kingdom of New Granada, in the beautiful valley of Bogota, about 1347 toises high, there also exist but two species, which the inhabitants of that country call *capitan* and *guapucha.* The one is an *atherine,* and the other a new genus of *apodes,* that I am about to describe in this memoir. The form of its tail and its anal fin distinguish it sufficiently from the genus *trichiurus,* which is also found in the fresh waters of South America. I have designed this non-descript fish at the place; and Messrs. Laccpede and Cuvier, who have willingly examined my descriptions, like me, consider it a new genus well characterized. I have named it *eremophilus* on accout of the solitude in which it lives at so great

---

* From *Recueil d'Observations de Zoologie et d'Anatomie comparé,* 1re livraison. Communicated by a correspondent.

† The French toise is about six feet four inches nine-tenths English.

an elevation, and in waters wh
no other living being. The nat
species of the same genus may b
situations, may change the nam
thrichomycterus, taken from th
tached to the nose of this fish.

EREMOPHILUS. (

APOD. CHARACTER GENE

Corpus elongatum. Cirri max
losi 2. Pinna dorsalis et an
stega radiis 1—2.

E. MUT

Corpore elongato, plumbeo, cœ
olivaceis variegato; operculi
spinuloso-serrata.

The body of the *captain* of B
analogy with that of the eel. It
gray colour, and spotted with
the outline of which forms very
in some individuals a yellowish
flat. The mouth, situated at
straight. The upper jaw proj
first, very long and double, is f
billons or whiskers, of which t
est. Two other barbillons, sh
placed on the nostrils. It ha
veiled by a semi-transparent m
and lampreys. The extremity
little teeth resembling hairs.
but short. The operculum or
branchial opening, and it is ve
folds (lames). In the most pa
have examined, it appears to m
the *cyclopterus dentex* and a f
radii or furrows, which are as
other. The edge of the oper
The dorsal fin has eight radii,
anus six, and that of the tail,

it has no swim or air-bladder. The length of this fish is from 10 to 11 inches, and its body is covered with a mucus common to the greater part of the apodes. It inhabits the little river of Bogota, that forms the famous cataract of Tequendama. The captain is a very agreeable aliment, and so much the more precious, that without it the inhabitants of the capital of Santa Fé, in the time of Lent, would be reduced to the use of only salted sea-fish brought from a great distance. I have given this species the trivial name *Mutisii* in honour of the celebrated naturalist, whose rich collections are preserved in the great valley of Bogota.

The little river of Palacé, near Popayan, nourishes another fish, which, by its mucosity and the position of its fins, has some relation with the *eremophilus*, but which ought also to constitute a new genus of apodes. The breadth of its head is greater than that of the body; its eyes placed on the upper part of the head, and turned so that the pupils are directed, like as in the *uranoscopus mus*, towards the surface of the water; the indenting of the first radii of the fins, the branchial membrane of four radii; the tongue; the want of barbillons or whiskers on the nostrils; and the dorsal fin, which approaches more to the head than the tail; sufficiently distinguish the *pescado negro* (black fish) of Popayan from the *capitan* of Santa Fé. I have given the name of *astroblepus* to this genus, in allusion to the extraordinary situation of its eyes.

ASTROBLEPUS. (See Plate VIII.)

APOD. CHARACTER GENERICUS ESSENTIALIS.

Corpus plagioplateum. Membrana branchiostega radiis 4. Oculi verticales. Cirri 2 maxillares, nasales nulli.

A. GRIXALVII.

Corpore ex olivaceo nigrescenti, capite subtruncato, radiis pinnarum exterioribus serratis.

Corpus plagioplateum, oblongum, nudum, olivaceo-nigrescens, caudam versus angustatum, subcompressum. Caput obtusum, magnum, subtruncatum. Cirri 2, apice recurvi et sublati, ricto in labio superiori adnati. Maxilla labiata, labio superiori majori plicatili. Lingua nulla. Nares 2

magnæ, margine membranaceo.
Operculum simplex, convexum,
chiostega radiis 4, ossiculo anter
toralis radiis 10. Pinna analis
integra radiis 12; radiis duobu
pinnarum) extrorsum serratis.

I have given this fish the s
perpetuate the memory of a re
Mariano Grixalva, who has diss
for the physical sciences, which
success.

The *pescado negro*, so much
but in that part of the river Cau
to the city. The physical cause
ficiently striking. From the v
rivulet impregnated with sulphu
call *Rio Vinagre* (Vinegar River
tiful cascade which it forms at t
the point where the waters of V
of Cauca until four leagues low
fish, although in the upper pa
The small quantities of acid tha
analysis are often sufficiently g
tion of fishes.

---

* *Mutisii* and *Grixalvii* are doubtless
gratify his puerile vanity, introduced th
ing names of men to plants: Werner
system of pitiable ambition in baptizi
Indeed, that such is his attachment to
ceremony of sprinkling certain stones,
vourite name of some of his follower
men's names to the very opposite ab
fish! All the labours of these men hav
for the natural sciences, than the intro
effected in obstructing the advanceme
phy. Posterity, so far from veneratin
who, to conceal his real ignorance by t
could thus deliberately bury true scienc
the ruins of a Babylonish jargon! Pea
he himself made no real discoveries, ye
of those of the English and other phil
by succeeding generations.—*Translator*

LX. *Memoir on a new Species of Pimelodus thrown out of the Volcanoes in the Kingdom of Quito; with some Particulars respecting the Volcanoes of the Andes. By M.* DE HUMBOLDT *.

THE chain of the Andes, from the Straits of Magellan to the northern shores bordering on Asia, extending over more than 2000 leagues, presents above fifty volcanoes still active, of which the phænomena are as various as their height and local situation. A small number of the least elevated of these volcanoes throw out running lava. I have seen, at the volcano of Zurnllo, in Mexico, a basaltic cone that sprung from the earth the 15th September 1759, and at present rising 249 toises (1595¾ feet) above the surrounding plain. The volcanic ridges of Guatimala cast out a prodigious quantity of muriate of ammonia. Those of Popayan and the high plain of Pasto present either *solfatares*, which exhale sulphureous acid, or little craters filled with boiling water, and disengaging sulphurated hydrogen, which decomposes by contact with the oxygen of the atmosphere. The volcanoes of the kingdom of Quito throw out pumice-stone, basaltes †, and scorified porphyries; and vomit enormous quantities of water, carburetted argil, and muddy matter, which spreads fertility from eight to ten leagues around. But, since the period to which the traditions of the natives ascend, they have never produced great masses of running melted lava. The height of these colossal mountains, that surpasses five times that of Vesuvius, and their inland situation, are, without doubt, the principal causes of these anomalies. The subterranean noise of Cotopaxi, at the time of its great explosions, extends to distances equal to that from Vesuvius to Dijon. But, notwithstanding this intensity

---

* From *Recueil d'Observations de Zoologie et d'Anatomie comparé*, 1re livraison.

† It would have been of some use to geology had the author here mentioned whether the stone which he calls basaltes has been submitted to the action of fire or water; or whether, in addition to the other well known characters of this mineral, it yielded hydrogen gas on distillation, the latter being the peculiar characteristic of what is properly denominated basaltes.—*Translator.*

sity of force, it is known, that if the volcanic fire was at a great depth, the melted lava could neither raise itself to the edge of the crater, nor pierce the flank of these mountains, which to the height of 1400 toises (8971⅔ feet) are fortified by high surrounding plains. It appears, therefore, natural, that volcanoes so elevated should discharge from their mouth but isolated stones, volcanic cinders or ashes, flames, boiling water, and, above all, this carburetted argil impregnated with sulphur, that is called *moya** in the language of the country.

The mountains of the kingdom of Quito occasionally offer another spectacle, less alarming, but not less curious to the naturalist. The great explosions are periodical, and somewhat rare. Cotopaxi, Tungurahua, and Sangay, sometimes do not present one in twenty or thirty years. But during such intervals even these volcanoes will discharge enormous quantities of argillaceous mud; and, what is more extraordinary, an innumerable quantity of fish. By accident, none of these volcanic inundations took place the year that I passed the Andes of Quito; but the fish vomited from the volcanoes is a phænomenon so common, and so generally known by all the inhabitants of that country, that there cannot remain the least doubt of its authenticity. As there are in these regions several very well informed persons, who have successfully devoted themselves to the physical sciences, I have had an opportunity of procuring exact information (*renseignemens*) respecting these fishes. M. de Larrea, at Quito, well versed in the study of chemistry, who has formed a cabinet of the minerals of his country, has been, above all others, the most useful to me in these researches. Examining the archives of several little towns in the neighbourhood of Cotopaxi, in order to extract the epochs of the great earthquakes, that fortunately have been preserved with care, I there found some notes on the fish ejected from the volcanoes. On the estates of the marquis of Selvalegre the Cotopaxi had thrown a quantity so great, that their putrefaction spread a fetid odour around. In 1691 the almost extinguished volcano of Imbaburu threw out thousands on the fields in the environs of the city of Ibarra. The putrid fevers which commenced at that period were attributed to the miasma which exhaled from these fish, heaped on the surface of the earth and exposed to the rays of the sun. The last time that Imbaburu ejected fish was on the 19th of June 1698, when the volcano of Cargneirazo sunk, and thousands of these animals enveloped in argillaceous mud were thrown over the crumbling borders.

---

* M. Humboldt seems not to have been aware that this name has been affixed to it in consequence of its having some resemblance to a kind of blackish coarse bread made of grits or pollard, and used in Spain by some very poor but proud people, or for purposes of penitence in cases of a *pecado mortal*.—*Translator.*

The Cotopaxi and Tungurahua throw out fish, sometimes by the crater which is at the top of these mountains, sometimes by lateral vents, but constantly at 2500 or 2600 toises above the level of the sea: the adjacent plains being 1300 toises high, one may conclude that these animals issue from a point which is 1300 toises more elevated than the plains on which they are thrown. Some Indians have assured me that the fish vomited by the volcanoes were sometimes still living in descending along the flank of the mountain: but this fact does not appear to me sufficiently proved: certain it is, that among the thousands of dead fish that in a few hours are seen descending from Cotopaxi with great bodies of cold fresh water, there are very few that are so much disfigured that one can believe them to have been exposed to the action of a strong heat. This fact becomes still more striking when we consider the soft flesh of these animals, and the thick smoke which the volcano exhales during the eruption. It appeared to me of very great importance to descriptive natural history to verify sufficiently the nature of these animals. All the inhabitants agree that they are identical with those which are found in the rivulets at the foot of these volcanoes, and called *prennadillas* *: they are even the only species of fish that is discovered at the height of above 1400 toises in the waters of the kingdom of Quito. I have designed it, with care, on the spot, and my design has been coloured by M. Turpin. I have observed that the *prennadilla* is a new species of the genus *silurus*. M. Lacepede, who has also examined it, advised me to place it in that division of *silurus* which, in the fifth volume of his Natural History of Fishes, he has described under the name of *pimelodes*.

---

* This word is an indifferent or contemptuous diminutive, indicating abundant, pregnant, fruitful, easily taken, but not a pleasing or desirable object. The name is purely Spanish and not Indian, of course could never have been applied to any fish used as food by Spaniards.—*Translator.*

This new species of *pimelodus* has a depressed body of an olive colour mixed with little black spots. The mouth, which is at the extremity of the nose, is very large, and furnished with two barbillons or whiskers attached to the jaws. The nostrils are tubulous; the eyes are very small, and placed towards the middle of the head. The skin of the body and the tail is covered with an abundant mucus, and the mouth is furnished with very small teeth. The branchial membrane has four radii, like the *pimelodus chilensis*; the pectoral fin has nine; the ventral five; the first dorsal six; the fin of the anus seven; and that of the tail, which is bifid, has twelve radii. The first radius of all the fins is indented on the outside: the second dorsal fin is adipose, and placed near the tail. This little *pimelodus*, which is found in lakes even to the height of 1700 toises, is, without doubt, the fish that lives in the most elevated regions of our globe. Its common length scarcely amounts to ten centimetres (four inches); but there are varieties which do not appear to reach five centimetres (two inches) in length.

In the system of ichthyology this new species of *pimelodus* should be ranged in the first sub-genus established by Lacepede, among the forked-tailed pimelodes. It must be in the first species, before the *pimelodus bagre*. As it is the only one of that division that has but two whiskers, I give it the name of

PIMELODUS CYCLOPUM. (Plate VIII.)

Cirris duobus, corpore olivaceo nigro-punctato.

This little fish lives in rivulets at the temperature of 10° of the centigrade thermometer, while other species of the same genus exist in rivers in the plains the water of which is at 27°. The *pimelodus* is but very rarely eaten, and then only by the most indigent race of Indians; its aspect and the sliminess of its skin render it very disgusting.

From the enormous quantity of *pimelodes* that the volcanoes of the kingdom of Quito occasionally discharge, one cannot doubt that country contains great subterranean lakes which conceal these fishes; for the individuals that exist in the little rivers around are very few in number. A part of those rivers may communicate with the subterranean pits: it is also probable that the first *pimelodes* which have inhabited these pits have mounted there against the current. I have seen fish in the caverns of Derbyshire, in England; and near Gailenreuth, in Germany, where the fossil heads of bears and lions are found, there are living trouts in the grottoes, which at present are very distant from any rivulet, and greatly elevated above the level of the neighbouring waters. In the province of Quito, the subterraneous roarings that accompany the earthquakes; the masses of rocks that we think we hear crumbling down below the earth we walk on; the immense quantity of water that issues from the earth in the driest places during the volcanic explosions; and numerous other phænomena, indicate that all the soil of this elevated plain is undermined. But, if it is easy to conceive that vast subterranean basins may be filled with water which nourishes fishes, it is more difficult to explain how these animals are attracted by volcanoes that ascend to the height of 1300 toises, and discharged either by their craters or by their lateral vents. Should we suppose that the *pimelodes* exist in subterranean basins of the same height at which they are seen to issue? How conceive their origin in a position so extraordinary; in the flank of a cone so often heated, and perhaps partly produced by volcanic fire? Whatever may be the source from which they issue, the perfect state in which they are found induces us to believe that those volcanoes, the most elevated and the most active in the world, experience, from time to time, convulsive movements, during which the disengagement of caloric appears less considerable than we should suppose it. Earthquakes do not always accompany those phænomena. Perhaps, in the different concamerations that may be ad-

mitted in the interior
sionally condensed, an
contributes to raise th
from a concavity dista
fire; possibly, in fine,
animals are enveloped
heat. Notwithstanding
cently made on volcan
volcanic productions t
the nature of the con
terranean fires, and the
selves, I believe that a
ders of craters, and wh
nity of volcanoes, will
still very far from bein
without being contrary
physics, could account
canic explosions presen

The corregidor of th
has communicated to
pimelodes. "It is kn
still preserved,) that th
of its great eruption or
enormous quantity of
occasionally to do so,
served that these fishe
mountain, and that th
in a rivulet at the ve
rock. This fishery do
in moonlight: a very
the *prennadillas* will n
the interior of which
light is injurious to th

---

* This is an assertion so
food, and disagreeable in a
of the translator, that the
tical and very witty, and
ropeans would be their hig
regarding the letter of *el Se*
sarcastic observations of Fr

accustomed to so strong a stimulus: an observation so much the more curious, that the *pimelodes* of the same species, which inhabit the brooks in the vicinity of the city of Quito, live exposed to the brightness of the meridian sun.

LXI. *Memoir on a new Species of Monkey found in the eastern Declivity of the Andes. By M.* DE HUMBOLDT[*].

In the vast plains which extend from the eastern declivity of the Andes towards the shores of the Brazils, in the thick forests on the Amazons, Rio Negro (Black River), and Oronoco, the *cavia capybara*, *sus tajassu*, and the monkeys, are the quadrupeds most common. The marmose and alouate prevail over all the others, whether for variety of species or number of individuals. Some of these monkeys, such as the capuchin of Oronoco, very different from the *simia capucina* Linn., the tiger-monkey or cusicusi, and the widow, (three new species which I have discovered,) live in pairs, melancholy, mistrustful, flying (like man in a savage state) their proper species. Others, especially the sagouin and howling monkey, are seen in troops, from 80 to 100, springing from branch to branch in search of nourishment. The *saimiri* of Buffon, that are the *titi* of Atures (*simia sciurea*), so esteemed on account of their gaiety, their mildness, and extreme littleness, assemble together when it begins to rain. A fall of temperature of three or four degrees of the centigrade thermometer disturbs them so much, that they mutually embrace each other and form balls or knots, of which each individual seeks to occupy the middle, in order to find shelter. The Indian hunters, advertised by the cry of the titi, direct their arrows towards these flocks.

Notwithstanding the great number of monkeys that naturalists have described, it is probable that we are still ignorant of the tenth part existing. In Africa, and even in South America, there are vast plains of twenty thousand

---

[*] From *Recueil d'Observations de Zoologie et d'Anatomie comparé*, 1re livraison.

square leagues which
ropean. On the othe
mon are still so imp
recent works, execute
who have seen the liv
recognise them in the
cite as examples the
pucina, and even th
commonly eaten in t

Among the great
that I had the opport
tropics, I have chose
remarkable for its
which I made a dra
My sketch has been
(Plate VIII.)

The *leoncito*[*] is
inhabits the plains
the Cordelliers, the
queta: it never asce
the wandering band
their excursions to
even Mont Perdu.
simia leonina, differ
has not the white
work of Audebert.
saki or fox-tailed
which covers the t
and from the *s. ia*
rings, by its black
tion that exists be
nails on its hinder
claws of a cat, and
toes. The *leonc*
without counting
body. It is one o
we have seen. It

---

[*] *Leoncito*, from *leon* (
with the Spaniards than

animals, very irascible. When it is vexed it bristles up the hair on its neck, that increases its resemblance to the African lion. I have seen but two individuals of this very rare monkey: they were the first that had been brought living to the west of the Cordellier. They were kept in a cage; and their movements were so rapid and so continual, that I had much difficulty to design them. Their hissing imitates the song of little birds, and I suppose that the conformation of their larynx (having a particular sac) is analogous to that which I have described in the *simia œdipus.* I have been assured, that in the cottages of the Indians of Mocoa the leoncito breeds in the domestic state. By the way of Grand-Para and the river of Amazons they might be brought into Europe. If a government, interested in the progress of descriptive natural history, would undertake an expedition in which that interest would not be rendered subservient to geographical discoveries; if that government sent canoes or small boats to ascend the Oronoco, and to penetrate by the Casiquiaré and Rio Negro to the river of Amazons; in short, if, after having explored the mouths of the Caqueta and Putumayo, it would make these same boats descend to Grand-Para, it would in a little time unite collections the most precious to the study of zoology and botany. Such an expedition would be of little expense, and its success certain.

SIMIA LEONINA.

Ex olivaceo fuscescens, facie atra, ore albo, dorso striis albo-flavescentibus notato.

Caput parvum, depressum, nigrescens. Facies anthropomorpha, atra; macula albo-cœrulescens circa os et nares. Auriculæ subtriangulares distantes, margine superiori deflexo, magnæ, aterrimæ, pilosæ. Corpus ex badio olivaceum, pilis nigro-annulatis, in collo longioribus. Dorsum maculis et striis albo-flavescentibus variegatum. Cauda non prehensilis, longitudine corporis, superne atra, inferne badia, apice incurva et incrassata. Manus et pedes aterrimi, inferne nudi, pollice in manibus anterioribus et posteriorbus distante. Ungues acuti, incurvi, atri; pollicis ungue in manibus anterioribus oblongo, acuto, in manibus posterioribus (pedibus) obtuso, anthropomorpho.

LXII. *Analysis of*
RICHARD PHILL
British Mineralo

THE nature of t
circumstances, hav
have given chemica
springs at that pla
unnecessary.

As to the cause
few data from whi
conjecture on the s

These waters ha
merited the attentio
early and extensive
also on account of
subject. Of these
to show that they

Of the sensible
most remarkable i
which varies consid
hot bath it is 117°
cross bath 109°.
with what has be
These results were
bulb of a thermome
taste is metallic, b
has not been univer
this impression is r

Their specific gra
as the effects prod
similar, they may
the temperature va
sage to the surface.
of the king's bath
it does not appea
have followed the

---

* From the unp

Before the experiments made upon the water are related, it will be necessary to state those employed to ascertain the properties of the gas, which rises in great quantity through the water in the king's bath.

This gas is perfectly free from smell.

(A) Some of the gas was received into a jar. A lighted taper put into it was immediately extinguished.

(B) Received into lime water, it caused an immediate precipitation.

(C) Tincture of litmus suffered no change of colour by agitation with the gas.

(D) The colour of dilute tincture of turmeric and infusion of galls was destroyed by it.

From these effects the gas appears to consist principally of nitrogen gas with a small portion of carbonic acid gas. To ascertain the quantity of each, and whether any oxygen gas was present, the following experiments were performed:

(E) One hundred measures of the gas were strongly agitated with barytes water in a graduated tube. A considerable precipitate was deposited, and five measures were absorbed.

(F) One measure of nitrous gas was added to an equal quantity of the gas in an eudiometer in the water apparatus. The mixed gases underwent no alteration of colour or diminution of volume.

(G) One hundred measures of the gas which had been deprived of carbonic acid by barytes water were submitted to the action of solution of green muriate of iron impregnated with nitrous gas. No absorption took place.

This gas, therefore, consists of,

Carbonic acid gas - -	5
Nitrogen gas - - -	95
	100

I now proceeded to try whether the water held either of these gases in solution.

(H) Ten ounces of the water, which had been cooled in a well closed bottle, were put into a vessel furnished with a

bent

bent tube; the water
and the gas evolved f
except a quantity too
in a graduated jar o
sorbed 3-4ths of an
acid.

(I) The unabsorbe
ratus, and tried in
mean result of comp
spheric air showed t
and that no nitrogen

As ten ounces of
bonic acid, one quart
quite exact, it being
of the carbonic acid

Effects of

(K) Some of the
in a vessel of broad
few hours a small q
which had been coo
transparent after sev

The re-agents ad
fects produced by th

(L) Acetate of le

(M) Tincture of

(N) Tincture of
sence of uncombin
destroyed.

(O) Lime water

(P) Ammonia,–

(Q) Carbonate

(R) Some of th
—ammonia added

(S) Oxalate of

(T) Nitrate of
acid.

(U) Nitrate of
nitric acid.

(V) Sulphuretted hydrogen water,—no precipitate or change of colour; the water became very slightly turbid.

(W) Prussiate of potash,—no immediate effect: after some weeks the water became slightly green.

(X) Infusion of galls,—immediately a peach-blossom red colour, and very soon a precipitate which became dark purple by exposure to the air.

All the above effects are also produced after the water has been cooled, excepting that the colour of tincture of turmeric is not then destroyed, and, under some circumstances, no red colour occurs upon the addition of infusion of galls.

(Y) A quantity of the water was evaporated to dryness, and distilled water added to the residuum. Nitrate of lime poured into the solution afforded a crystalline precipitate in a few hours, indicating the presence of an alkaline sulphate.

I shall now state the inferences to be deduced from these experiments.

Carbonic acid exists in this water (B E). A considerable portion of it escapes at the high temperature at which the water is obtained, its evolution occasioning the precipitation of some substance which it held in solution (K).

From Experiment (L) it is evident that no sulphuretted hydrogen gas is present.

As no alteration of colour is effected upon tincture of litmus by the carbonic acid (M), it is evident that acid is present only in sufficient quantity to dissolve the substance precipitated by its evolution.

The destruction of the colour of tincture of turmeric (N) is clearly occasioned by the gas during its passage through the water (D).

The effect produced in Experiment (O) is owing to the formation of carbonate of lime, and the precipitation of it and of the substance previously dissolved by carbonic acid (K).

A part of the precipitate obtained by adding ammonia (P) must have been similar to that of Experiment (K), and to a portion of that of Experiment (O), produced in (P) and (O) by combining the solvent carbonic acid instead of expelling

it as in Experiment (
lime, or of magnesia,

As earthy carbonat
bonates, the precipitat
indicates the presence

From Experiment (
nesia exists in the wat
Experiment (K) was
Dr. Gibbes, sulphate
ever, that Dr. Saunde
it forms no part of th
dition to the experim
be incompatible wit
the addition of a sol
immediate precipitati

As Dr. Gibbes ha
mention what appear
In reply to Dr. Sau
which he took for
stated that it was pre
after oxalic acid ha
This method is subj
to have been employ
an alkali; and, as ox
it is evident that, if
was sufficient to pr
portion of oxalate o
the lime previous to
an alkali to combin
of oxalate of lime: a
or saturated, it also
circumstances I sus
monia was oxalate o
from acids by alkali

Experiment (S) d

Experiment (T) s
water.

The effect, prod
the action of muriat

As no metallic oxide, discoverable by sulphuretted hydrogen, was suspected, the appearance it produced (V) was supposed to be derived from its action upon carbonate of lime. This was ascertained to be the case by direct experiment.

The prussiate employed by Experiment (W) was the triple compound containing oxide of iron. It was imagined that the slight greenness which was assumed by the water might be occasioned by the action of the carbonic acid, notwithstanding its holding carbonate of lime in solution, this effect being easily produced by the application of the stronger acids. A small quantity of the triple prussiate was therefore added to a solution of carbonate of lime in carbonic acid: after a considerable time it acquired a green colour exactly similar to that observed in Experiment (W). Dr. Falconer has indeed stated that a blue colour is to be obtained by the action of prussiate of potash upon the water; but, as it did not occur till after the addition of sulphuric acid, it is evident that this effect was produced by the action of the acid upon the oxide of iron of the prussiate.

Although the presence of oxide of iron is not at all indicated by prussiate of potash, (probably on account of the smallness of its quantity,) yet it is evident from the action of infusion of galls (X) that a minute portion of it actually exists in the water; the light colour of the recent precipitate, and its becoming darker by contact with atmospheric air, showing that it is in the state of protoxide. In making this experiment it is requisite to use a very small quantity of the infusion of galls; for, if much more than five drops of it are added to one ounce of the water, no indication of oxide of iron is produced, the water becoming of a light reddish brown colour, and affording no precipitate. An excess of this infusion re-acts upon the compound of vegetable matter and oxide of iron so completely as to prevent the appearances readily presented by a small quantity.

From the well known laws of chemical affinity it is evident that the oxide of iron is combined with carbonic acid; this compound undergoing some curious changes, which have occasioned much discussion.

It has been observ
oxide of iron does n
of its presence; and
municates when hot
analysts. This tast
bottles; and every n
has been unsuccessf
action of infusion of

The proofs that th
isting under singular
not surprising that t
dence. It has been
yellow ochrey precip
the precipitate being
which has been add
of iron is, that the s
with it: this obser
oxide appears not to
from the stone, by t
tained in it, by the
Having procured a
which the sides of
or two of nitric acid
and completely oxy
to that which has l
water.

Another fact has
above stated, whic
come stained with i
bright yellow colou
are made changes t
nor has it any res
effected merely by
find that solutions

The observation
respecting the oxid
of galls to detect
under what circum

(*a*) About one

to the atmosphere in a vessel of broad surface. After it had remained about 16 hours, a small quantity of carbonate of lime was deposited by the evolution of carbonic acid gas. The precipitate was perfectly white, and had not the slightest appearance of containing oxide of iron. To this water infusion of galls was added without occasioning the least alteration of colour.

(*b*) As the quantity of oxide of iron in the water is evidently extremely small, it may be imagined that it was precipitated with the carbonate of lime, but escaped observation from the minuteness of the quantity. To obviate this objection, some of the water was closely stopped in a phial for four or five days: upon examination it was found to possess its transparency perfectly, and without having afforded any precipitate; to some of this, infusion of galls was added without producing the slightest indication of oxide of iron.

(*c*) Some of the water which had been cooled so as to retain its transparency, was heated to its original temperature; infusion of galls was then added, but without producing any effect.

The facts exhibited in Experiments (*b*) and (*c*) have been long known, and have given rise to an idea that the iron is volatilized. Although this opinion is incompatible with facts already mentioned, yet it may not be amiss to show more particularly that it is completely erroneous. As it cannot be imagined that the temperature of the water is sufficient to volatilize mere oxide of iron, the existence of some substance capable of carrying it off must have been supposed. That muriatic acid and muriate of ammonia possess this power at high temperatures is well known, but no uncombined muriatic acid or muriate of ammonia is present. Hydrogen gas is said also to be capable of volatilizing iron; but the gas evolved from the water has been shown to consist of nitrogen gas and a small quantity of carbonic acid gas, and to neither of these gases, alone or combined, has any such power been attributed. If, however, they really possess it in this instance, they must be regarded as the solvent of the iron, and the effect produced upon infusion of galls must be de-

rived from th
water. If thi
trated solution
effect upon th
the gas destro
increasing it,
of iron.

(*d*) About
of considerabl
thirds: it was
four hours. I
blossom colour
very considera

It is remark
have proved s
the circumstan
the vessel and
was exposed w
no action on it
exposure, it det

From this c
change was pr
that it had not
former experime
and depth of the
fact against thi
detected when
fect in this case

To try the eff
ments were perf

(*e*) A small q
in a well stopped
of atmospheric a
fectly transparen
not afford the sli

(*f*) Another
length of time i
except such as th

occasioned exactly the same appearance of iron in this as in the water when fresh and hot (X).

That the action of infusion of galls is lost by the absorption of the oxygen of atmospheric air is proved by the following experiment:

(*g*) A third quantity of the water was enclosed, with the usual precaution, in a phial, about one-half of which was occupied by the gas evolved from the water in the bath, which has been shown to contain no oxygen gas. After four days, infusion of galls was added to it, and gave the same appearances of oxide of iron as occur in its application to the fresh hot water.

Having thus ascertained the effect of oxygen in preventing the action of infusion of galls upon oxide of iron, it remained to be shown in what manner this is effected. I imagined it might be produced by increasing the power of combination of the oxide of iron so as to admit of its acting upon the earthy contents of the water and forming compounds, the strong affinity of the constituents of which prevented the action of the infusion of galls. With a view to ascertain how far this supposition was correct, I examined the effects produced by adding carbonate of lime, dissolved by carbonic acid, to solution of sulphate of iron to which infusion of galls had been previously added; and although it will appear, by the following experiments, that the alterations produced upon the oxide of iron in the water are caused by the carbonate of lime it contains, it will also be found that they are not effected in the way I had supposed.

A very dilute solution of green sulphate of iron was prepared: the quantity of oxide of iron contained in it was so small as scarcely to afford any alteration of colour when infusion of galls was added to it; but upon pouring solution of carbonate of lime into it after infusion of galls had been added, a deep red colour was almost instantaneously produced.

Although this fact did not immediately appear likely to solve the difficulties attendant upon the water in question, yet it was sufficiently striking to merit an examination by

what means the ca
to what extent it
of galls a more act

With this inten
iron in alcohol till
separated. The r
I shall consider th
state of protoxide.
dissolved in water,
in a given portion
the average of two

(*h*) To one oun
a grain of protox
This occasioned th
sence of oxide of
produced, increas
atmosphere.

(*i*) An equal
prussiate of potas
produced by the
had escaped the a
colour was gradu
air till the iron ha

(*k*) Infuion of
solution of carbo
of oxide, as in th
of very considera

(*l*) The last
$\frac{1}{10000}$dth of a g
distinct red purpl
of the infusion o

(*m*) To one o
taining $\frac{1}{1000}$dth
added; but it di
upon the oxide

I now prepare
ing the green su
quantity of oxid

former case ascertained. The experiments made with this were as follow:

(*n*) One ounce of a solution of red sulphate of iron, containing $\frac{1}{1000}$dth of a grain of oxide, was treated with infusion of galls. The usual indications of its action upon oxide of iron were presented.

(*o*) The addition of prussiate of potash to an equal quantity of the solution immediately occasioned a blue colour.

(*p*) Infusion of galls was added to one ounce of a dilute solution of carbonate of lime containing $\frac{1}{1000}$dth of a grain of the peroxide of iron. Slight indications of its action upon the oxide were produced, but the colour was scarcely more intense than that effected by $\frac{1}{10000}$dth of a grain of protoxide in similar circumstances: no effect whatever was produced by infusion of galls upon $\frac{1}{10000}$dth of a grain of peroxide in one ounce of solution of carbonate of lime. The colour produced when carbonate of lime and infusion of galls are added to the peroxide is red purple, similar to that occasioned by their action upon the protoxide.

(*q*) To one ounce of a solution of carbonate of lime, containing, as in the last experiment, $\frac{1}{1000}$dth of a grain of peroxide of iron, prussiate of potash was added. Not the slightest blue colour was produced. When carbonate of lime was thus added to the solution of peroxide of iron, I found that it was capable of preventing the action of prussiate of potash upon $\frac{1}{150}$th of a grain.

From these experiments it is evident that carbonate of lime possesses, in a very great degree, the power of increasing the action of infusion of galls upon protoxide of iron; while, on the contrary, it diminishes its power in detecting peroxide of iron; and is, moreover, capable of preventing the action of prussiate of potash.

The application of these experiments to the circumstances of the water in question is obvious. It has been shown that it contains carbonate of lime; and that the power of infusion of galls to detect the oxide of iron it contains is completely lost by the absorption of oxygen. The following experi-

ment was made wit
effect of slow oxidize

(*r*) Infusion of ga
upon $\frac{1}{10000}$dth of a
of solution of carbor
of iron containing
solved in one ounce
and was kept in cont
of atmospheric air,
of that time the solu
without having prec
galls did not occasi
acted upon the oxi
of power of infusion
than in the Bath wa
mospheric air cont
while no oxygen ga

When carbonate
well known that do
being thus combin
sulphuric. Having
instances, acts mu
sulphates, I imagin
its effect in this wa
was correct I made

(*s*) A quantity o
similar to that emp
was decomposed b
was passed throug
iron was diffused,
fusion of galls was
lour effected by th
phate of iron and
deep blue colour w

(*t*) One-tenth c
ployed in the last
carbonate of lim
To this infusion

colour was immediately produced, and from its intensity it was evident that carbonate of lime had increased the power of infusion of galls as much in employing the carbonate as the sulphate of iron.

It may be concluded, from these experiments, that the effects produced by carbonate of lime are not attributable entirely, if at all, to the conversion of the sulphate of iron into a carbonate. Hence I was induced to examine the appearances produced by the action of the various alkalies and earths upon infusion of galls and solutions of iron. The results are by no means uninteresting, but the limits usually allotted to an analysis will hardly admit of the necessary detail; I shall therefore relate only such facts as appear requisite to explain the changes occurring in the Bath water, reserving the statement of the remaining experiments for a future opportunity.

I now proceeded to examine the salts produced by evaporating the water and crystallisation.

(a) A quantity of the water was evaporated to dryness: the residuum was treated with distilled water as long as that fluid continued to dissolve any portion of it. This solution was again evaporated, and upon cooling yielded a considerable quantity of acicular crystals. These were again dissolved in distilled water; and to a part of the solution nitrate of barytes was added, which occasioned a copious precipitate. The same effect was produced by oxalate of ammonia; but ammonia caused no precipitation. These crystals were therefore sulphate of lime. By further evaporation the solution afforded cubic crystals of muriate of soda and prismatic crystals of sulphate of soda.

The next object to be attained was the weight of the total quantity of the various substances held in solution by a given portion of the water. This has been given, with considerable variation, by different analysis, as will appear by the following statement. From a quart of the wtaer

Dr. Lucas obtained 33¼ grains of dry residuum.
Dr. Charlton - 34
Dr. Falconer - 17¾
Dr. Gibbes - 23¼

To account for
Saunders has suppo
or that the residuu
heat. I have ascer
water several times
observing any othe
ble in experiment.
be remarked, that I
by Dr. Falconer.

It is scarcely pr
analyses were obta
temperature than 2
I find that one qua
172 grains, at the
residuum dried at
employed, 30 grai
grains. The greate
four grains; where
to explain, the ext
cited is 16¼ grains.
of the loss is occasi
nate of lime; for
turmeric paper of a
of the residuum is
the upper part of
but not at all appe
suspected that it mi
ter: to ascertain wl
experiment was ma

(*v*) Four pints of
a retort, and the re
alcohol. The filtere
of a yellowish-colo
solved in water, and
nitrate of silver, bu
carbonate of ammo
only salt dissolved

(*w*) To the rema
less sulphuric acid

a dark brown colour, evidently derived from its action upon carbonaceous matter. This experiment did not appear conclusive, as two causes of error might have existed,—a small quantity of alcohol was probably decomposed by the action of the salts upon it, or some of the conferva which is found in the water might have escaped notice previous to evaporation. I had recourse, therefore, to other means. Mr. Kirwan, in his Treatise on the Analysis of Mineral Waters, gives a method for ascertaining the presence and quantity of extractive matter proposed by Westrumb, which consists in precipitating the muriatic salts by nitrate of lead, and afterwards the extractive matter by nitrate of silver. It is impossible to conceive any method more completely fallacious than this; for extractive matter is as readily precipitated by nitrate of lead as by nitrate of silver; and although muriate of soda is decomposed by nitrate of lead, muriate of lead being a salt of considerable solubility, the subsequent addition of nitrate of silver would decompose it, and afford a precipitate consisting of muriate of silver without any extractive matter.

The power of sulphuric acid to detect carbonaceous matter is extremely great: $\frac{1}{100}$dth of a grain of sugar was dissolved in four ounces of water; to this solution about one ounce of sulphuric acid was added: it was then boiled till nearly the whole of the water was evaporated, and the acid had acquired a very distinct brown colour.

The following experiment was now made:

(*x*) A quantity of sulphuric acid was added to one quart of the water perfectly transparent, and free from heterogeneous matter. The mixture was evaporated nearly to dryness in a retort, and the acid remained perfectly colourless. The water, therefore, contains no carbonaceous matter.

The substances contained in the water, as shown by the foregoing experiments, are; carbonate of lime, oxide of iron, sulphate of lime, muriate of soda, and sulphate of soda. The presence of these compounds has been universally allowed; but that silica is contained in the water, was discovered by

Dr.

Dr. Gibbes. To f
lowing methods w
(*y*) A quart of t
platina crucible: th
thirty grains. Thi
distilled water, till
trate of barytes. T
equal quantities.

(*z*) To one of th
as long as precipita
poured on the prec
muriate of silver th

(*A*) The second
monia while it cont
pitated oxalate of li

(*B*) To the remai
rytes was added til
and the sulphate
weighed, after wash
riments.

(*C*) The residuum
dried, two grains: n
This solution afford
copious one with ox
trate of lime obtaine

(*D*) The ·3 of a
solved by potash, an
monia. This precipi
and was consequentl

Another quart of
To avoid prolixity, I
tate afforded by on
and make the requis
two experiments.

Residuum
Muriate of silver
Oxalate of lime

	Exp. I.		Exp. II.	Mean.
Sulphate of barytes	36·6	grains	36·9	36·7
Carbonate of lime	1·7	do.	1·5	1·6
Silica	·3	do.	·4	·35

According to Dr. Gibbes, a quart of the water affords nearly 4 grains of silica when treated in the method I have described. Thinking it probable that a portion of it might be taken up by the action of the salts during their solution in water, I tried whether any larger quantity could be obtained by the following method:

(*E*) A quart of the water was evaporated to dryness in a platina crucible. The residuum was repeatedly treated with nitric acid in a red heat; the soluble parts were again dissolved by distilled water, and the portion insoluble in it, when dried, weighed ·4 of a grain. This agreeing exactly with the last experiment, I shall consider as the quantity of silica afforded by a quart of the water. This experiment was several times repeated, with very little variation in the weight of the result, but was sometimes evidently coloured by oxide of iron, which was separated from the silica, and its nature ascertained by the usual means. But, even when employing apparently perfectly similar means, the oxide of iron was not always to be obtained,—an effect attributable to the decomposition of the muriate of soda by the nitric acid, and to the power which muriatic acid possesses of carrying off oxide of iron; but for the uncertainty of its action it is not easy to account.

To find the quantity of oxide of iron contained in the water, the following means were employed:

(*F*) To a quantity of the hot water infusion of galls was added in the requisite proportion. The water measured when cold 9¼ pints. The precipitate obtained was separated by the filter, and dried:—the precipitate and filter were then burned together in a platina crucible, and the carbonaceous matter of the filter, and that combined with the iron, were got rid of by the application of a red heat. The residuum was then treated with nitric acid, in order completely to oxidize the iron:—it was then boiled with acetic acid to

take up the lime precip
infusion of galls ; and
any silica which the f
maining substance wa
·2 of a grain.

(*G*) The last expe
the method. Infusion
quantity of the hot wa
pints. The precipitat
ter poured off till onl
was evaporated, and th
a red heat, weighed ·5
heat with carbonaceou
solved in muriatic acid,
ed to be silica, derived
the precipitate formed
solution afforded a blu
·4 were therefore oxid

According to the ex
affords ·00421 of a gra
·00463, giving a mear
is in the state of prot
66·5 protoxide, and
the quantity of proto

242 of muriate of s
16·2 will therefore gi

100 of oxalate of li
lime, 18 will then gi

100 of sulphate of
18 will then produce
whole quantity of sul
the sulphate of baryt
as 100 of sulphate of
5·2 yield 3.

One quart of the v
Carbonic a
Sulphate o

Brought forward	-	20·4
Muriate of soda	-	6·6
Sulphate of soda	-	3·0
Carbonate of lime		1·6
Silica	- -	·4
Oxide of iron	-	·00394
		29·60394
Loss	-	·39606
		30·

Estimating the muriate and sulphate of soda in the crystallised state, one pint of the water contains nearly as follows:

Carbonic acid	-	$1\frac{1}{3}$ inch.
Sulphate of lime	-	9 grains.
Muriate of soda	-	$3\frac{1}{3}$
Sulphate of soda	-	$3\frac{1}{3}$
Carbonate of lime	-	$\frac{8}{10}$
Silica	- -	$\frac{1}{5}$
Oxide of iron	-	$\frac{1}{50}$

LXIII. *Proceedings of Learned Societies.*

ROYAL SOCIETY.

MAY 1. The right honourable the President in the chair.—On resuming the reading of Mr. Smithson's letter (not Tennant, as erroneously printed in our last report) it did not appear that the author had been able to collect any quantity of the *native* minium which he discovered in galena; nor does he mention in what country he found this mineral.

An anatomical dissertation, by Mr. Home, on the *teredo gigantea*, or sea-worm, with observations on the *teredo navalis*, or borer, was also read. The subject examined by this anatomist was one of those sea-worm shells brought by Mr. Griffiths from Sumatra, of which some account was given to the Royal Society in February last. The *teredo navalis* was brought from one of our ships at the Nore, in order

der to enable the autho
parative anatomy of th
borer he found a con
Mr. Tennant pronoun
to saw-dust. Notwit
of the borer's burying
concludes that wood
undigested; but that
gantea, draws its nour

May 8. The Presid
read a letter from M
Academy at Woolwic
the force of the leve
Isaac's demonstration
all the objections urg
reduced his defence
and maintained that t
and weight was equa
pass from the fulcrum

May 15. The Presi
ter to the President, f
ed action of the albur
Knight, discovering
ments of Hales and D
firm them by experim
the truth of the opin
communicated from t
the circulation of the
sap-wood, and to ve
present case his resea
tatoes, and he in con
of all such roots is e
he has been endeavou
action of the alburnc
seem to have been cc
leave little doubt of
nions. Perhaps the
phical botanist may
of hot-house or gre

dener's attention to the supply of that kind of air most easily assimilated by the lungs or respiratory organs of the different species of bulbous- and tuberous-rooted plants, and thereby find a new *pabulum vitæ vegetabilis.* It is, however, certain that we are yet very ignorant of the indefinite improvability of vegetables, and of the best means of multiplying them for the use of animal life.

May 22. The President in the chair.—A letter from Mr. Martin to the right honourable Mr. Greville, gave a brief description of a kind of mineral bason, or surface of a country, extending 100 miles in length, and 20 in breadth, through Wales, in Glamorgan and adjoining shires, which consists principally of iron ore and coals. Brief as this mineralogical topography is, it were to be wished that we had similar sketches of all the districts in Great Britain, as we might thence form more accurate ideas of the geology of the kingdom.

A letter from Mr. Dunlop to sir C. Blagden, bart. was likewise read, containing a description of an instrument newly invented by him, to be substituted for the common quadrant and sextant now in use, and by means of which the numerous errors occasioned by atmospheric refraction, and in taking lunar observations, &c. are to be completely obviated. Should this invention be found to answer these pretensions, it will be of inestimable consequence to navigators, as such is the imperfection of our present instruments, that no two observers can bring the sun to the same altitude on the quadrant, often differing from 4 to 7 miles in their observations: an endless source of errors and miscalculations in the course of a long voyage.

SOCIETY OF ANTIQUARIES.

May 1. The lord bishop of Salisbury in the chair.—A half-length portrait of sir Walter Raleigh was presented to the society by sir W. Skeffington, bart. In the letter which accompanied this present, it was acknowledged that the painting was only a tolerably old copy of some original: the upper part indeed was very well executed, but the hands were extremely incorrect and unnatural.

Designs of two to
hibited: the one was
other 700. They affo
having any allegorical

May 8. Craven Ord
Eight plans, elevatio
church of Norwich, b
exhibited. The societ
Several autograph lett
lady Raleigh, were rea
written in a very fair
which requested atter
sir Walter, in which l
in the unusual largen
also evince great po
speaking of the exec
have not refused me
life," has here a mor
reflection.

May 15. Craven C
copper Lydian coins,
hibited, and conside
seal, which contained
before the society.
Greek coins were exh
his ideas relative to a
he seemed disposed
ginary importance an
haps find it necessa
time, and may in cor

May 22. The Rev
reading the minutes
till the 5th of June.

SOCIETY FOR THE
TU

Tuesday the 27th
this truly useful and

premiums and rewards, at their house in the Adelphi, his grace the duke of Norfolk, president, took the chair; and the meeting was honoured by the presence of the baroness de Tott, count Woronzow (late ambassador from Russia), the Swedish, Portuguese, and Hessian ambassadors; and as many persons of distinction, and ladies of fashion and beauty, were also present as the great room of the society could hold, to the exclusion of many of the members, who handsomely gave up their places on this occasion. At twelve o'clock the chair was taken, and the business commenced with an oration by Dr. Charles Taylor, the principal secretary, on the patriotic views and labours of this society since its establishment in 1754; in the course of which he noticed the principal objects of public utility, which the premiums and bounties, from time to time given by the society, had brought to light and perfected; and entered into minute details on the design and objects of the premiums awarded in the present session. The worthy secretary observed, that the permission which the society gave in 1760 for the artists of that day to exhibit their pictures in the society's rooms, gave rise to that noble annual exhibition, since made in the Royal Academy's apartments in Somerset-house; and he took the opportunity of paying a just tribute of respect to the memory of the late Mr. James Barry, the sublime productions of whose pencil decorated the society's room, and whose remains were now deposited in St. Paul's cathedral, between those of sir Christopher Wren and sir Joshua Reynolds.

After the different premiums, &c. had been adjudged, his grace rose, and, in a short speech, thanked the company for their polite attention to the details of the business; and, adverting to the distinguished foreigners present, concluded with a handsome compliment to the attention paid by the Emperor of Russia to the arts of peace, and particularly to the talents and productions of Englishmen.

In our next number will be found a list of the names of those to whom medals or premiums were delivered at the above anniversary.

IMPERIAL RUSSIAN S

AT

This society is at pr
for the future use of
ing the Russian lang
speak highly of the
the Russias.

ROYAL

M. Mœller, direct
in Denmark, has thi
society for the best
question: "Upon t
and modern histori
pragmatical histori
such mistakes."

THE ROY

This academy has
for the present year
History—" Histo
and the manner of
middle ages." The
Greek, Latin, o
blance of the Lati
known by the appel
examination whethe
characterize these t
not be attributed,
ture, to the progre
human mind."
eats.

The essays must
fore the 20th of Ja

ATI

On the 31st of A
held a public mee
opened it with a di
and philosophy.

different members. One of these was an essay by M. Moreau, physician at Rochefort, on the property of charcoal in purifying water. Another essay was read by professor Fradin, on life in general, and particularly on old age: observations were also read by Mr. Boncenne, upon the fineness of taste and feeling: and M. Denesle, lecturer on botany, concluded with a treatise on the waters of Poictiers and the neighbourhood.

UNIVERSITY OF GOTTINGEN.

The following is announced as the subject of a prize question by this university: "What influence have oxygen gas, azotic gas, and the other gases, or their bases, upon the production of electricity by friction?" The beginning of September next is fixed for receiving the answers to the above, and the prize is 50 ducats.

MEDICAL SOCIETY OF BRUSSELS.

This society, since its re-establishment in the year 1804, has been employed in medical and philosophical researches of considerable importance. Two gold medals are given annually, the one of the value of 200 franks, for the best treatise upon any general medical subject; and the other, of 150 franks in value, for the best treatise upon any local disease peculiar to the department of Brussels. The subject of the prize essay for the year 1805, wa, "Whether has night any influence upon sick people; and what are the physical causes of such influence?" The prize was adjudged to Richard de la Prade, M.D. practising at Monbrison. The prize announced for the present year is for the best answer to the following question on a general medical subject: "What are the characteristic symptoms of the inflammation of the mucous system, and what phænomena are the consequences of such inflammation in regard to the organs in which it takes place; and what treatment ought we to follow in such a case?"

The prize will be adjudged in the public sitting of the 22d of September 1806.

LXIV. *Inte*

RUS

AFTER the ext
made by the Chin
the frontiers of C
the Chinese comm
bassador, count C
any part of his suit
Golowkin is ther
Pekin shall give a
of our court.

The differences
and the Chinese,
tain ceremonies, a

The balloon of
whose melancholy
came to the grou
leagues distant fro
unloaded pistol, a
found in the car o
The unfortunate
following observati
seems that the mi
did not result fro
connected with aë
of prudence. The
low; the cords b
were too far apa
ment was leaning
that he lost his ba
If the accidents w
vestigated, it will
ceeded from the
Every one foresa
a balloon filled

Pilatre de Rosier was exposed. Besides, those balloons were gilt; which might attract the electricity of the clouds. Balloons, gilt or silvered over, are very dangerous. Zambeccari, who employed those means, sustained several accidents, and it is only surprising that he escaped at last."

COFFEE.

M. Tussac, a colonial refugee from St. Domingo, has discovered the method of extracting from the pulp of coffee-berries a spirituous liquor similar to rum, and remarkable for a peculiar flavour which indicates its origin. This discovery will be very useful in the colonies, as the pulp, when separated from the berries, was hitherto used only as dung; and also because it may be substituted, to good account, in place of the rum and the tassia in common use. M. Tussac has sent a bottle of this liquor to the Museum of Natural History at Paris, and all who tasted it have declared that it was excellent.

He sent at the same time the model of a machine called a kiln, with the assistance of which the same quantity of coffee grains may be dried in three days, as could have been dried in six weeks if spread upon hurdles. This machine is a species of barrel or cylinder, the sides of which are constructed of brass wires, fastened to iron rods; it admits of being easily seen through; it is divided into six or eight compartments, and a wooden axle runs through its whole length, to the extremity of which is adapted a handle. It is placed in a stove some feet above the surface, then half filled with coffee grains, and turned round by means of a horse or water mill. As this large box turns round, the coffee grains contained in it keep continually moving about; the partitions or compartments in it prevent the coffee from going too much to one side; the warm air of the stove passes through the intervals, the humidity is dissipated, and the dried clay or sand is easily separated.

M. Tussac has it in contemplation to publish a history of the vegetables of the Antilles, in which he purposes to give the process of distilling spirits from coffee, as well as a description and a drawing of the above kiln for drying the grain.

The Swedish as
the prize bequeath
the best work on a

M. Leonhard,
has announced an
on mineralogy, u
ginal communicat
lume on the 1st o
Mineralogical Po

Several of the
sent engaged in n
influence of musi

A lying-in hos
ony, upon an ext
for its erection ha
vided for its ann

The editors of
premium of a gol
the best answer t
proximate causes
rious miasmata w
the air, or are t
they depend mere
that all stimulant
The answer m
Italian, Spanish,
before the 17th J

The emperor
in-law prince Bo
its contents at th
able collection o
ed to Paris in or

TRAVELS.

A letter from Goree, dated 3d March, 1806, gives the following information respecting Mr. Park: "We have just received information from the interior, that Mungo Park has been some time on the banks of the Niger, but could not build the boats as he intended, his carpenters being all dead, together with all the soldiers of our corps (35 in number) who went with him, except seven; who, with Mr. Park, Lieutenant Martyn of our corps, and a Mr. Scott an artist, have proceeded in canoes down the Niger; a brother-in-law of Mr. Park (named Anderson) went with him, as surgeon, but died on the banks. They all left Goree in April last. I saw the negro who brought the information, and have every reason to believe he is correct. Should you meet with any of Mr. Park's friends, this news may be acceptable to them. About seven weeks since he was seen in good health."

The counsellor of the mines of Denmark, M. Gieseke, who lately returned to Copenhagen from his voyage to the Faro Islands, has received permission from his Danish majesty to set sail for Greenland, where he will undertake a mineralogical and geographical inquiry into the state of that extensive country.

LONGEVITY.

In the list of persons who died in the year 1805, in the heptarchy of Pinsask, in Russia, five of them were 110 years of age; one of 113; four of 120; one of 128; one of 130; and one of the uncommon age of 150 years!

CHEMISTRY.

Mr. Parkes's Catechism, for the use of those who are entering upon the study of chemistry, and which we announced in our Number for December last, is now published in one volume octavo.

LECTURES.

On Monday, June 2d, a Course of Lectures on Physic and Chemistry will recommence at the Laboratory, Whitcomb-street, Leicester-square, at the usual morning hours:

viz. Therapeutics at
after 8; and the Cl
Pearson, M.D. F.
Hospital, &c. &c.

The Practice of V
tion, 44, Broad-stre
proposed in a forme

Further particular
or at 52, Leicester-s

LIST OF PA

To Anthony Fran
in the West, in the
chine for casting or
usually made use of

To William Bun
parish of St. Pancr
matical-instrument-
the purpose of maki
1806.

To Stephen Hoo
rey, gentleman; fo
cleansing docks an
tain improvements
he hath already ob
and other harbours
other purposes. M

To William Rob
parish of St. Andre
tin-plate worker; fo
turing tin or iron pl
tin plates, into cove

To Martin Cawo
an improvement in
conveying and stop

To Richard Will
in the county of S
ments in steam-en

METEOROLOGICAL TABLE,
BY MR. CAREY, OF THE STRAND,
For May 1806.

Days of the Month.	Thermometer. 8 o'Clock, Morning.	11 o'Clock, Night.	Noon.	Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
April 27	45°	52°	43°	30·10	22°	Cloudy
28	42	47	40	29·78	25	—
29	43	55	45	·56	35	Cloudy
30	46	54	46	·67	28	Showery
May 1	50	56	51	·80	29	Cloudy
2	54	63	53	·60	48	Fair
3	48	46	41	·78	0	Rain
4	45	46	44	30·06	17	Rain
5	44	52	46	·02	5	Rain
6	50	64	55	29·78	30	Fair
7	55	68	55	·59	36	Fair
8	56	69	56	·56	45	Fair
9	54	63	56	·50	15	Cloudy
10	55	67	55	·65	60	Fair
11	50	62	55	·80	11	Cloudy
12	50	59	45	·75	27	Fair
13	45	51	48	·70	5	Cloudy
14	50	60	52	·40	0	Rain
15	55	62	53	·59	42	Fair
16	55	66	54	·94	51	Fair
17	54	65	55	30·02	41	Fair
18	58	70	54	·30	70	Fair
19	56	65	51	·35	65	Fair
20	52	69	50	·20	66	Fair
22	51	48	68	·18	50	Fair
23	50	62	51	·20	60	Fair
24	54	71	52	·02	62	Fair
25	56	73	61	29·99	57	Fair
26	60	73	59	·90	71	Fair

N. B. The barometer's height is taken at noon.

IN

ACADEMY a
Göttingen, 9
of Genoa, 28

Acid, muriatic.
of, by Galv
170, 172,
Acids. Effects o
culi,
Aërostation,
Affinities, chemic
Agricultural mac
Alkalies. Effec
calculi,
American Societi
Analysis of chro
of guano, 1
131; of ox
Paris waters,
retted oxide o
of Bath hot s
Anatomy,
Antimony. On

Antiquaries. So

Antiquities,
Apodes. Two ne
Artillery. Paten
Asafœtida. Exp
Astroblepus. On
Astronomy,
Athenæum at Po
Atmosphere. St
103; *Marin*
Azote, gaseous o

Chromate of iron. Analysis of, 3
Cioni on production of muriatic acid by Galvanism, 167
Cities. *Antient*, discovered, 284
Civilization. A prize question, 188

Clark's patent, 191
Clough's patent, 191
Coffee. Spirits from, 368
Collard on chemical affin. 284
Collenbuch on urine, 44
Cometarium. Walker's, 37
Compression. Effects of, on heat, 140, 193
Copenhagen. Society of Sciences, 187
Copper precipitated by tin! 284
Crane. Patent, 94
Cranks and flys. Patent respecting, 94
Crusades. A prize question, 278
Curr's patent, 190
Cuthbertson on production of muriatic acid by Galvanism, 170

Dalton on elastic fluids, 8, 15; on absorption of, by water, &c. 15; on theory of mixed, 103
Dampier's patent, 190
Deafness cured, 92
Decarro on the Cachemire goat, 97
Dispan on gaseous oxide of azote, 215
Distillation. Imptovement in, 37
Dropsy cured by bohea tea, 91
Dufour on destroying insects in gardens, 213
Dunbar's meteorological observations, 95
Dunlop's new quadrant, 363
Dyeing. On, 49, 69

Earth. Rotatory motion of, 93
Economical Society, Bahama, 282
Egan on gravelly and calculous concretions, 25, 114
Elastic fluids. On, 8, 15
Electrical experiments, 73
Electrogent of Schmidt. On, 250
Epilepsy cured by vital air, 247
Eremophilus. On the, 329
Erfurt Academy, 89

Falling bodies. On, 93
Filtration on a large scale, 314
Finsbury Dispensary, 221
Fire-arms. Patent, 94
Flinders' meteorological remarks, 271
Fluids, elastic. On, 8, 15; weight of, 24; on respiring, 51; theory of mixed, 103
Flys and cranks. Patent respecting, 94
Fossil skeleton found in Gloucestershire, 92
Fourcroy's analysis of bones, 262
Freezing. A prize question, 187
French National Institute, 278

Galvanic Society, Paris, 183
Galvanic chain described, 183
Galvanism, 91, 167, 170, 172, 176, 183, 203
Gases. On mixtures of, 8; on absorption of, by water, &c. 15; on weight of, 24; on respiring, 51, 215; theory of mixed, 103
Gasometer. Steevens's, 163
Germain on spirits from potatoes, 209
Gibson on sutures in skulls, 256
Goerlitz Society, 187
Gold. On oxide of, 69
Göttingen Academy, 90; university, 187
Gravelly concretions. On, 25, 114
Gregory's treatise of mechanics, Account of, 265
Gregory on the lever, 362
Griffiths on a worm-shell, 82
Grinding of woods, &c. Patent for, 196
Guaiacum. Exper. on, 64

Guano. On,
Gums. Exper. on,
Gun-locks. Patent,

Hall (Sir J.) on he
compression,
Hatchet on tannin,
Haussman on metal
dyeing,
Hawkins on vaccin
Heat. Effects of,
compression,
Hemp spinning. Pat
Hen. A remarkabl
Hermbstadt's black
Herschel on solar m
Hides. Patent for s
Higgins on manufac

Hill on pneumatic
Hinchliffe's patent,
Holbein's Dance of
stroyed,
Holme on caoutcho
Home on prostate gl
sea worm,
Horse-shoes. Patent
Hortentz on produ
riates by Galvani
Humboldt on two n
apodes, 329; o
333; on a ne
monkey,

Japan. Russian em
Iceland. Improvem
Imperial Academy,
Imperial Russian So
Indian rubber. On,
Indigo. Exper. on,
Insects. To destro

Johnston's improve

Jones's patent,
Iron. White sulpha
——. On oxidati
sulphates of, 22
of,

Mines. Patent for working, 287
Minstrels, antient. On, 83
Missisipi river. Meteorological observations at, 95
Monkey. New species of, 339
Moon. On apparent magnitude of, 240
Muriates. Production of, by Galvanism, 91, 167
Muscovado Sugar. Manufacture of, 308
Music, 284

Naylor's patent, 94

Optical phænomena, 240
Orsted on sound, 251
Ottley's patent, 191
Oxidation of metals, 223
Oxides, metallic. On, 69
Oxygen gas. On respiring, 53

Pacchiani, on composition of muriatic acid, 176
Pallas. Tables of, 188
Park, the traveller, 371
Parr's patent, 191
Patent inventions. 94, 190, 287, 372
Peas. Exp. on, 64
Pelts. Patent for splitting, 191
Petrini, on production of muriatic acid by Galvanism, 167
Pfaff's experiments on respiration, 51
Pimelodus. New species of, 333
Pit-coal. Origin of, 81
Place's patent, 191
Plunkett's patent, 287
Phillips's analysis of Bath hot springs, 342
Phillips's patents, 94
Pneumatic medicine. On, 47, 246, 247
Potash. On production of, 91
Potatoes. To extract spirits from, 209
Preston's patent, 287
Prize questions, 187, 278, 281, 282, 365, 366, 369
Prussiates of iron. On, 232
Publications, new, 265, 368
Resins. Exper. on, 60, 81
Respiration. Experiments on, 51
Rotting. Patent to prevent, 190
Royal Society, 81, 180, 271, 361
Royal College of Surgeons, 276
Royal Jennerian Society, 84
Royal Society, Copenhagen, 365
Royal Academy, Stockholm, 365
Russian Embassies, 36, 366

Salt. Patent for making, 94
Sampson's patent, 94
Sarcocol. Exp. on, 63
Schmidt's electrogene. On, 250
Ships. Machine for transporting, 189
Skins. Patent for splitting, 191
Smithson's discovery of native minium, 274
Soap. Patent, 287
Societies. Learned, 81, 180, 361
Soda. On production of, 91, 244
Sonorous vibrations. On, 251
Spar. Recent production of, 182
Spirits from potatoes, 209
Steevens's gasometer, 163
Sternberg on electrogene, 250
Stone-sawing. Patent for, 94
Sugar. From beet-root, 91; on manufacture of, 308
Sulphate, white, of iron, 72
Sulphates of iron. On, 226
Surgery, 286
Sutures in skulls of animals. On, 256
Syphon. New application of, 37

Tannin. Hatchett on, 58, 81, 155
Taunton's dispensary report, 221
Taxation, a prize question, 187, 365
Tea, a cure for dropsy, 91
Telescope, patent, 190
Thenard on combinations of antimony and tin, 236
Tin. On oxide of, 69; combination of antimony with, 236
Tinder-box, patent, 94

Thornton

Thornton on pneu

Tragacanth. Exp
Transit instrument

Travels,
Trusses, patent,

University, *Götting*
Uric acid. On,
Urine. On progn

Vaccination, 84,

Vauquelin on gu
sulphuretted ox
nete,

Page 166, line 1
ver, again diss
167, l. 18, fo
l. 18, for " t
The plate of M
numbered Pl.

END O

Printed by

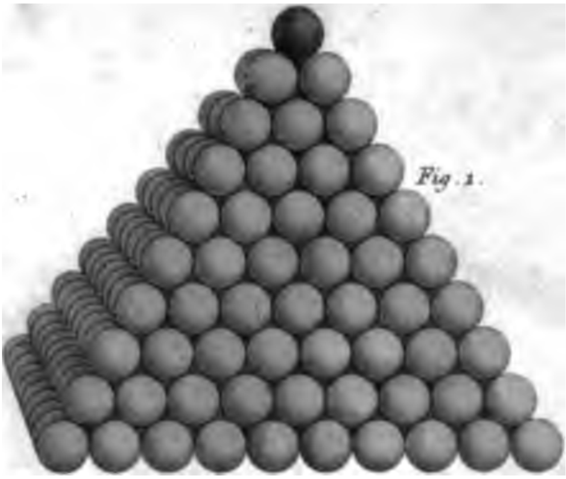


Fig. 1.

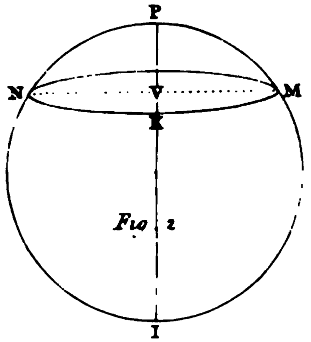


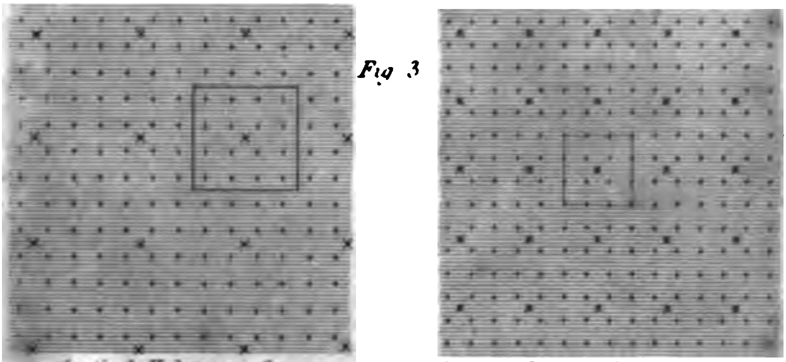
Fig. 2

Horizontal view of Air in Water

Incumbent Stratum of Atmosphere Particles marked thus •

Stratum of Air in Water marked thus ×

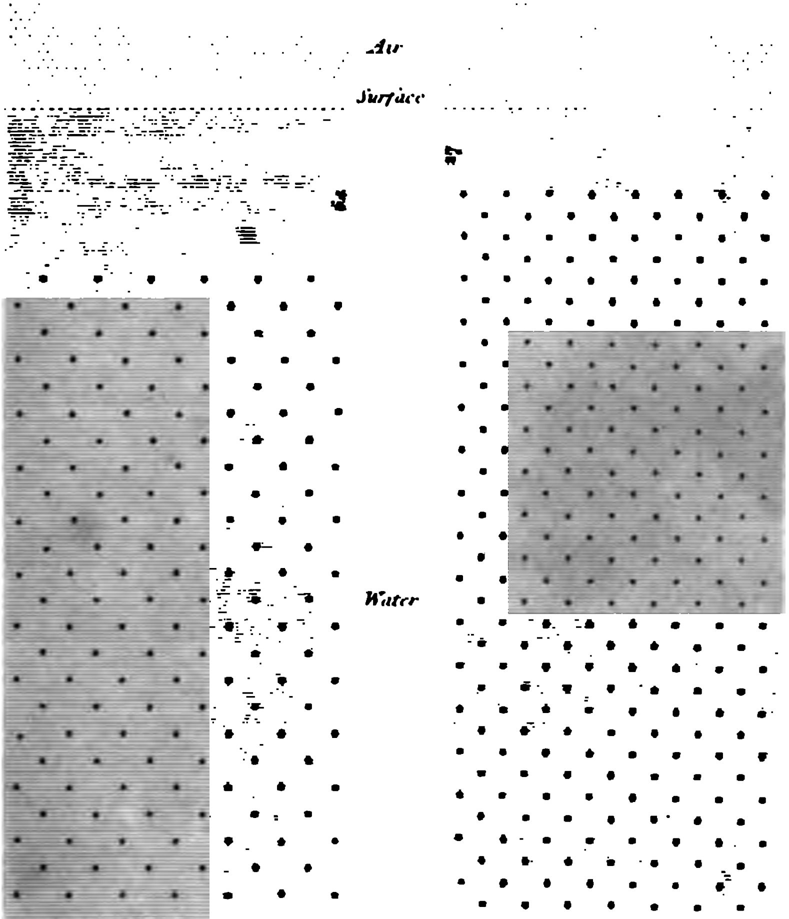
Fig 3



Azotic & Hydrogenous Gas
Distance of Particles 4 to 1.

Oxygenous Nitrous & Carburetted Hydrogen Gas.___ Distance of Particles 3 to 1.

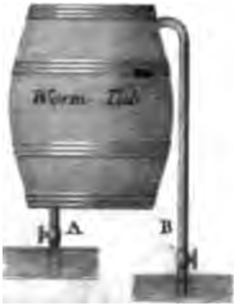
Profile View of Air in Water.



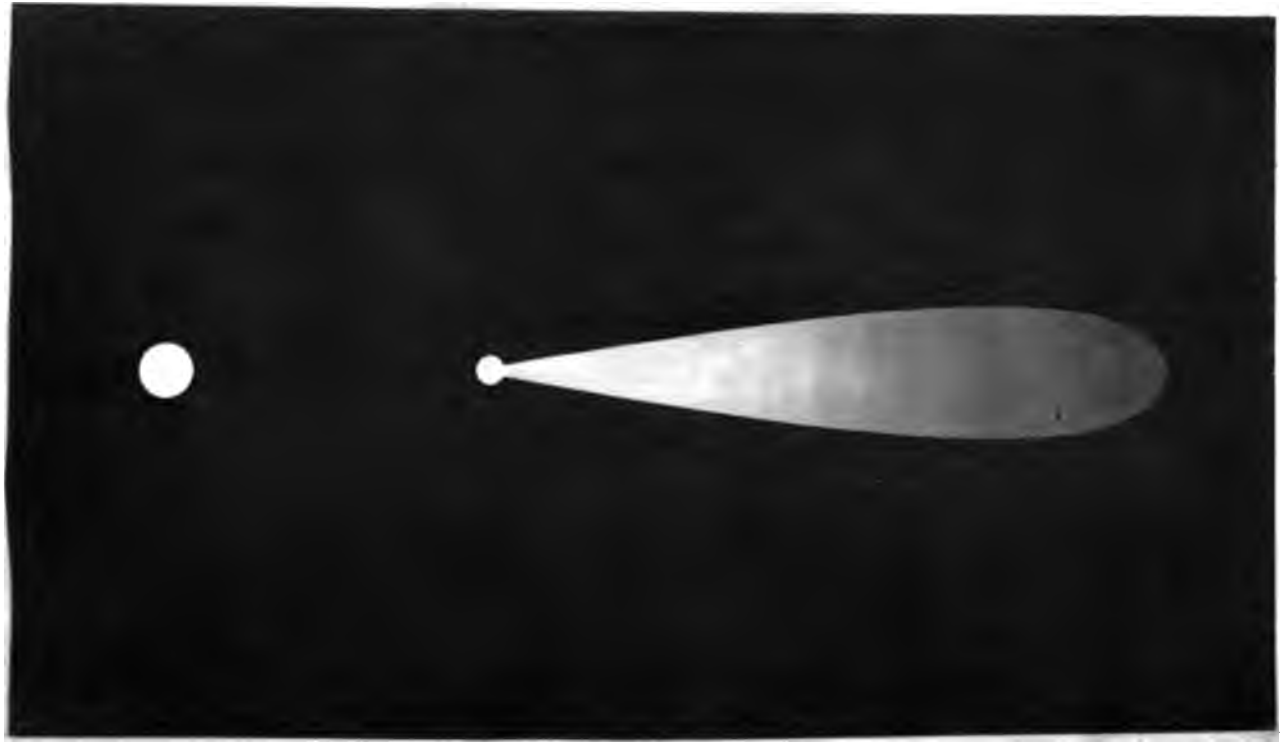
Azotic and Hydrogenous gas [illegible] Density

Oxygenous Nitrous & Carburetted Hydrogen gas [illegible] Density

Fig. 2



Mr WALKER'S PLANETARIUM.

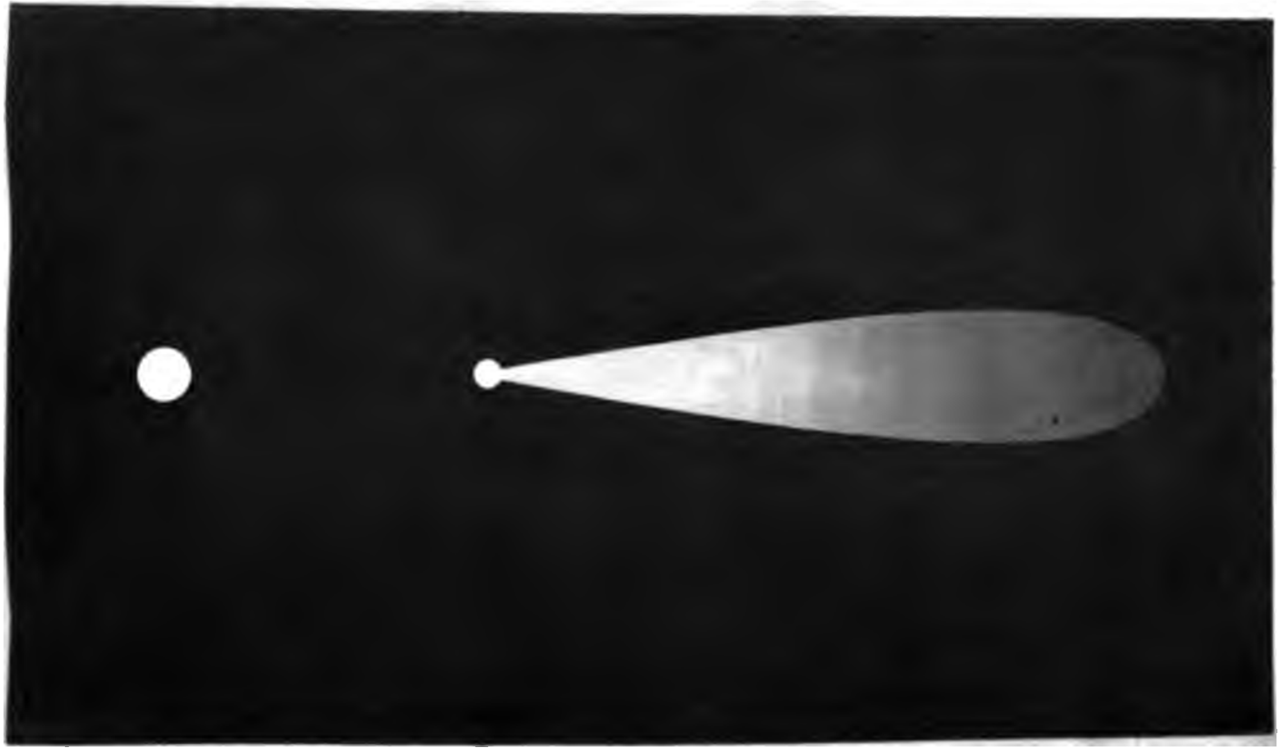


Lowry sculp

UN OF MICH

Phil. Mag. Pl. III Vol XXIV

Mr WALKER'S PLANETARIUM.



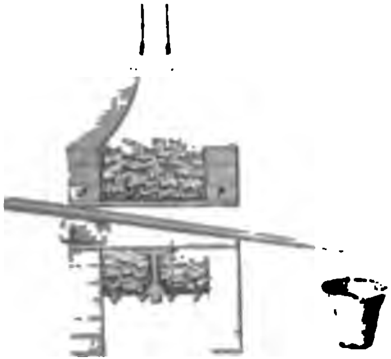
Lowry sculp

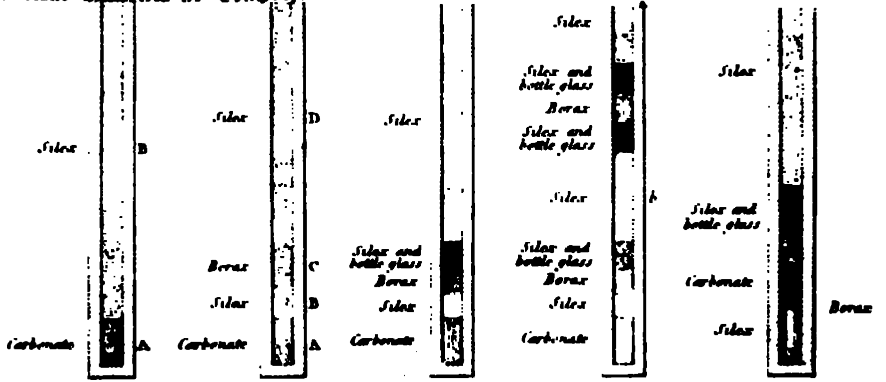
UN. OF MICH

Philo Mag. Pl. IV Vol. XXIV.

Effects of Heat modified by Compression.

Fig.

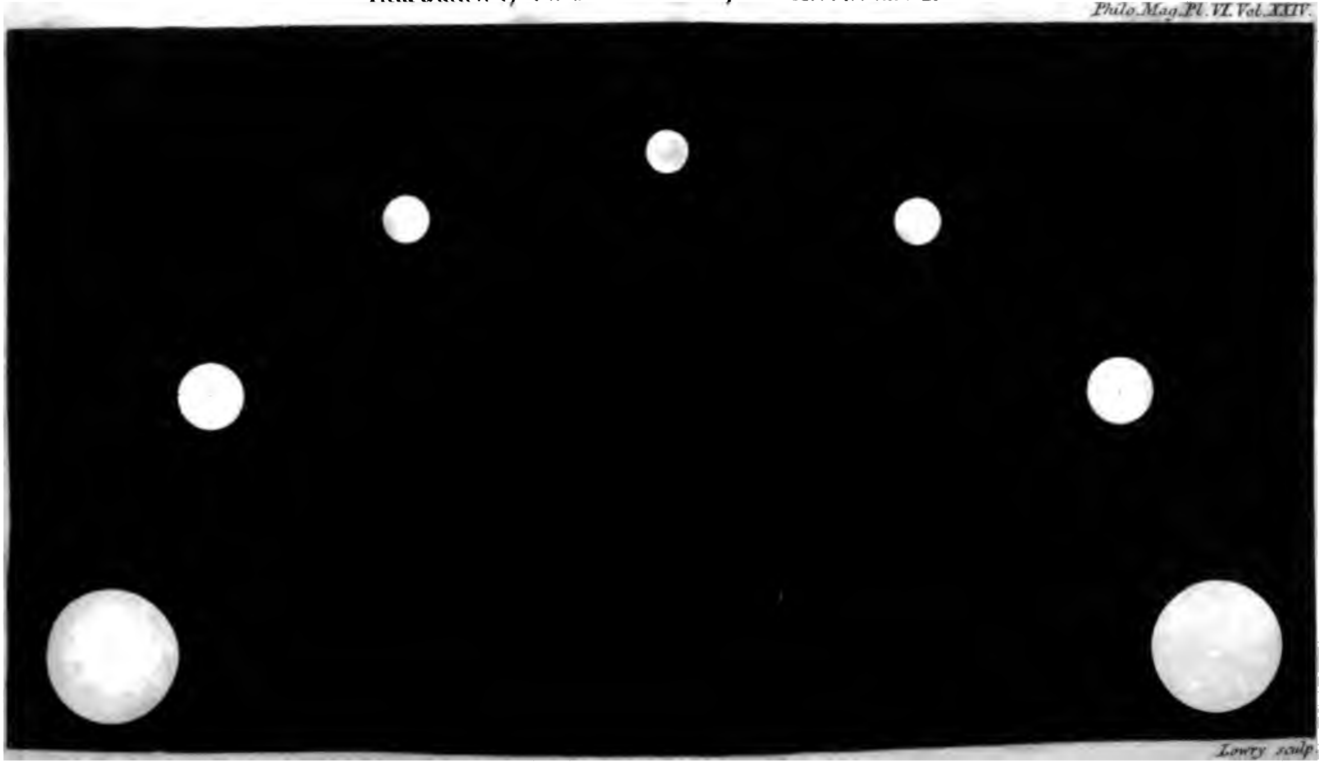




Lowry sculp

.94

Illustration of the Phænomenon of the Horizontal Moon.



Lowry sculp.

Fig. 14.

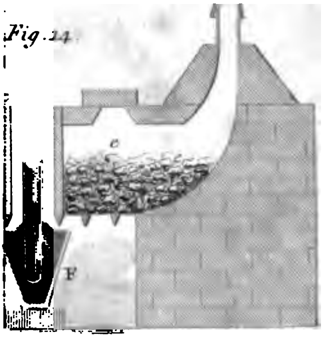
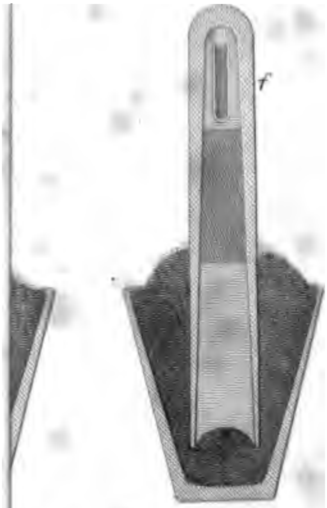
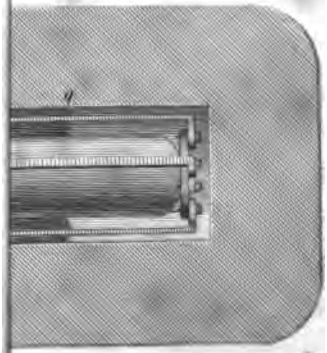


Fig. 16.





Lowry sculp.

UNIV. OF MICH.

Philo. Mag. Pl. VIII. Vol. [illegible]

Fig. 2.